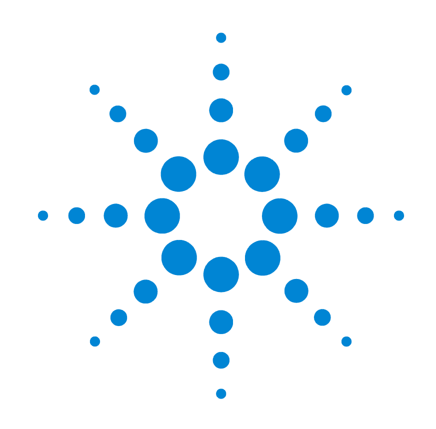


Agilent 3200I Ion Meter
离子计

User Guide
用户手册



Notices

Manual Part Number

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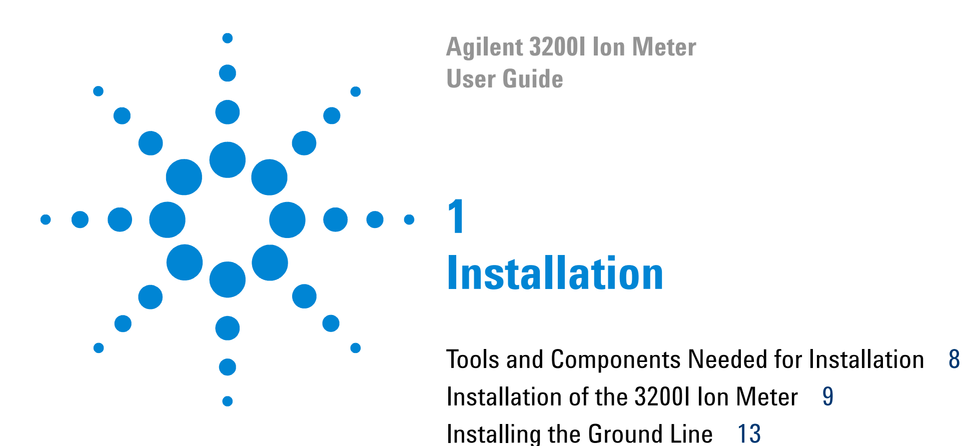
CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

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A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents



1
Installation

Use the tools and accessories shipped with 3200I Ion Meter during installation.

Tools and Components Needed for Installation

Agilent provides the tools needed for installation. The following accessories are included in the shipping case.

- Electrode holder (G4389A)
- Electrode
- Power adaptor (5185-8389)

Installation of the 3200I Ion Meter

Open the 3200I Ion Meter shipping case. Remove the meter, electrode holder, and other accessories.

Installation of electrochemical probes and electrodes

1 Place the electrode holder near the meter and move the arm into position. Use the thumbscrews shown in Figure 1 to secure the arm in place.

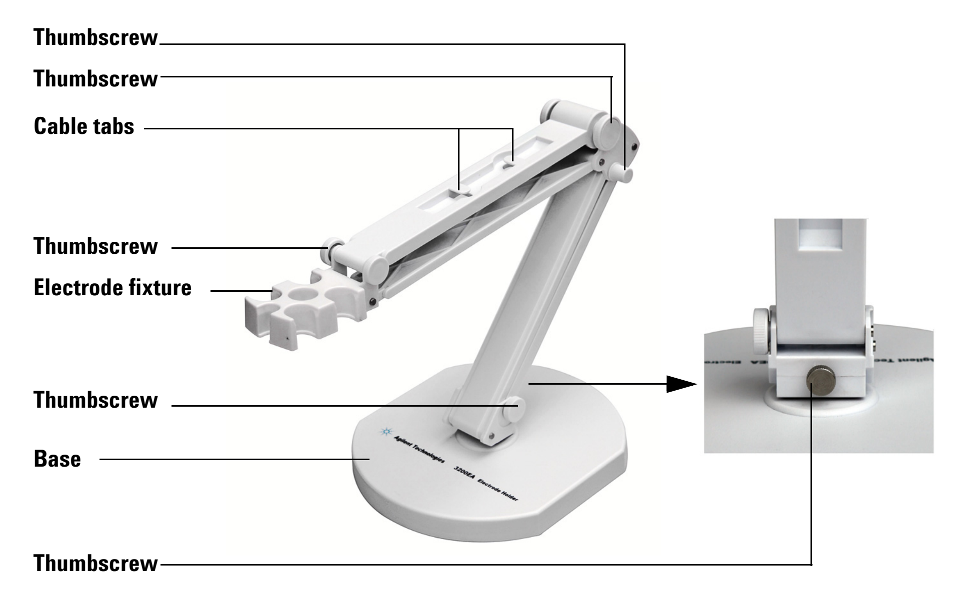


Figure 1 The electrode holder

2 Clip the pH/pX electrode and ATC probe into the electrode fixture shown in Figure 1.

3 Route the electrode cable as shown Figure 2.

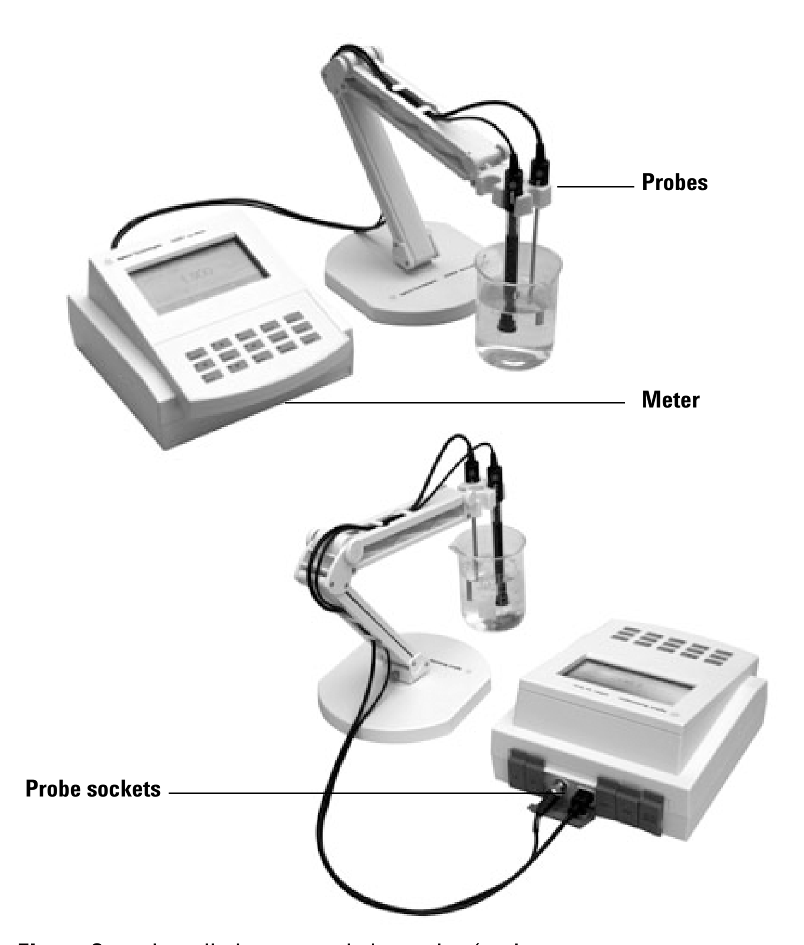


Figure 2 Installed meter and electrodes/probes

4 Locate the pH/pX and ATC probe sockets on the back of the meter. Plug the ion selective electrode (ISE) or pH combination electrode connector and ATC probe connector into the sockets on the rear of the meter. See Figure 3.

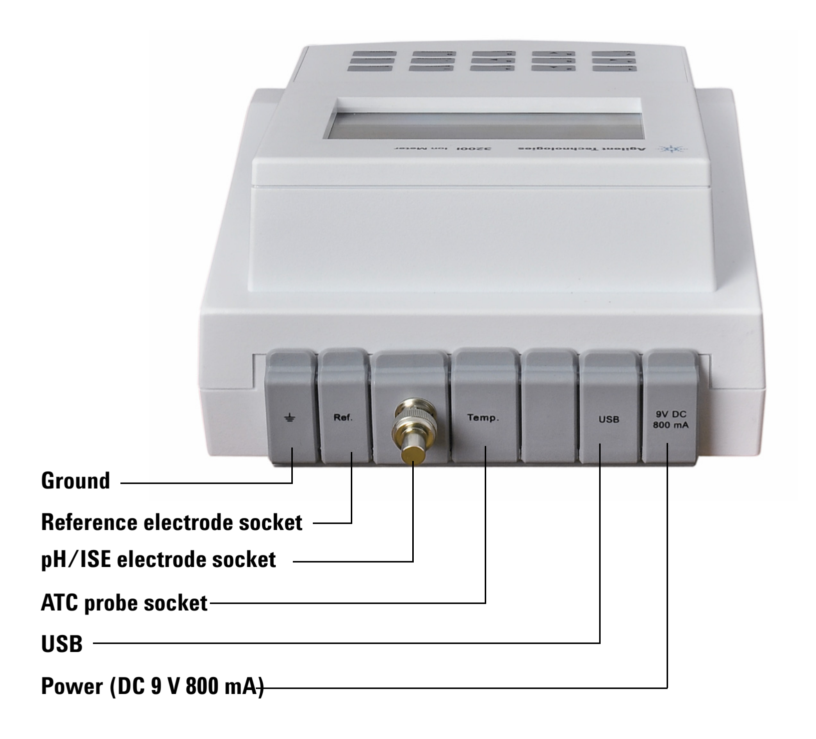


Figure 3 The back view of the 3200I Ion Meter

Installing the power adapter

A universal power adapter is included with the 3200I. The power adapter operates at 100–240 VAC, 1 A, 50/60 Hz. The output from the power adapter is 9 VDC 1 A.

CAUTION Do not use any other power adapter with the 3200I.

1 The power adapter includes several outlet adapters. Choose the appropriate outlet adapter for the power outlets in your country.
2 Slide the outlet adapter on to the two metal prongs on the power adapter. A click will be heard when the plug is properly engaged. See Figure 4.



Figure 4 Assembling the power adapter

3 Connect the power adapter cord to the power socket on the back of the meter. See Figure 3 on page 11.

Installing the Ground Line

Agilent provides a ground line with the meter, but normally you do not need to install it for use. If other devices, for example a constant temperature bath, causes electrical interference an unstable readings, use the ground wire. Connect the ground wire terminal to the meter and connect the other end to the interference source, for example the cover of the constant temperature bath.

Installing the Optional Software

If purchased, install the optional G4390A Electrochemical Data Collecting Software now. The software provides communications between the meter and a computer. Connect the computer to the meter with a USB cable. See the G4390A software documentation for more information.

If not using the G4390A software, Agilent provides downloadable data printing software on the Agilent Customer Portal (see "Agilent customer portal" on page 16). To use this software, download it from the portal and install it. Then connect the meter to the PC using the USB cable. Refer to the data printing software documentation for more information.

2
Operation

Introduction

Where to find information

This document describes how to install, operate, maintain, and troubleshoot the 3200I Ion Meter.

Before operating your meter, be sure to read the meter installation and operation information.

Agilent customer portal

Agilent also provides customized information for the products you own through a customer portal. This web service provides many customizable services as well as information related directly to your Agilent products and orders. Log onto the portal at **http://www.agilent.com/chem**.

Definition of terms

pH Slope

Refers to the mV change when the pH has been changed each unit and is represented by mV/pH or percent (%) of the theoretical slope.

pH E_0

Also called *Zero Potential* and refers to the mV value at pH7.

One-point calibration

Calibration with one pH buffer.

Multi-point pH calibration

Calibration with two or more pH buffers.

Proper use

To avoid common safety issues:

- Ground the meter using the connection on the back.
- The meter can be used continuously for a long time. After each measurement, soak the electrode in distilled water. If an electrode is out of use for more than 6 hours, rinse and store it in a protective container.
- Improper positioning of the electrode can result in abnormal measurements. When immersing the electrode in a sample solution, place the electrode in a location where the solution can flow freely around the electrode.

CAUTION The ion meter is an analytical instrument with high accuracy. To protect high resistance components from damage, place the short circuit plug (G4383-40000) shipped with the meter on the electrode connector when the meter is not connected with an electrode.

CAUTION Do not expose to corrosive gas. Keep the sockets on the back of the meter clean and dry. Do not allow contact with acid, alkaline, or salt solutions.

CAUTION Only use the power adapter included with the meter.

CAUTION When the short-circuit plug is not being used, it must be kept dry and clean. The plug could be damaged by high humidity. The meter could be damaged or the measurement affected if a damaged plug is used.

CAUTION Do not use where nearby vibrations will affect the performance. Do not use if corrosive gas is in the air. Do not use near strong electromagnetic fields.

Features of the 3200I Ion Meter

The 3200I Ion Meter is a state-of-the-art and customer-friendly benchtop analytical instrument, designed for the measurement of pH/pX, ion concentration, potential, and temperature in aqueous solutions with high accuracy.

Features include:

- Measurement of pH/pX, ion concentration, potential, and temperature.
- Automatic pH buffer recognition for buffers prepared according to NIST, DIN, and GB.
- Multi-point calibration up to five calibration points.
- Ion measurement modes for H^+, Ag^+, Na^+, K^+, NH_4^+, Cl^-, F^-, NO_3^-, BF_4^-, CN^-, Cu^{2+}, Pb^{2+} and Ca^{2+}.
- Custom defined ion measurement modes for other ions
- A clear dot-matrix LCD display
- GLP norm. Stores 200 pH data sets, 100 pX data sets, and 100 ion concentration data sets.
- The ability to view, output, and delete stored data
- Three measuring modes to meet the needs of various users:
  - Continuous Mode
  - Timed Reading (Timed Reading Mode)
  - Auto-Lock Mode (Auto-Lock Reading Mode)
- USB PC connectivity with available communication software
- Power-off protection. When the meter is manually or automatically shut off, the stored measuring data, calibration data, and setting parameters will not be lost.
- A back-lit design that can be used in a dark environment
- A durable key pad
- An Auto Power Off function
- A self-diagnosis mode for troubleshooting

Specifications

Measuring range	
pH	-2.000–20.000 pH
pX	0.000–14.000 pX
mV	-1999.9–1999.9 mV
Unit	pX, mol/L, ppm, %, mg/L, µg/L
Temperature	-5.0–110.0 °C
Resolution	
pH/pX	0.1/0.01/0.001 pH/pX
mV	0.1 mV
Temperature	0.1 °C
Accuracy	
pH/pX	±0.002 pH/pX
mV	±0.03% FS
Concentration	±0.3%
Temperature	±0.1 °C
Normal working conditions	
Environmental temperature	0–40 degrees
Relative humidity	≤ 85%
Power supply	Power adaptor, 5185-8389
Power input	100–240 VAC, 1 A
Power output	9 VDC, 1 A
Size	(length × width × height, mm): 190 × 190 × 105
Weight	about 1 kg

Physical overview

The Agilent 3200I Ion Meter is composed of a meter and an electrode system. The electrode system contains a pH combination electrode, an ion selective electrode, and an ATC probe held in place by the electrode holder. See Figure 5, Figure 6, and Figure 7.

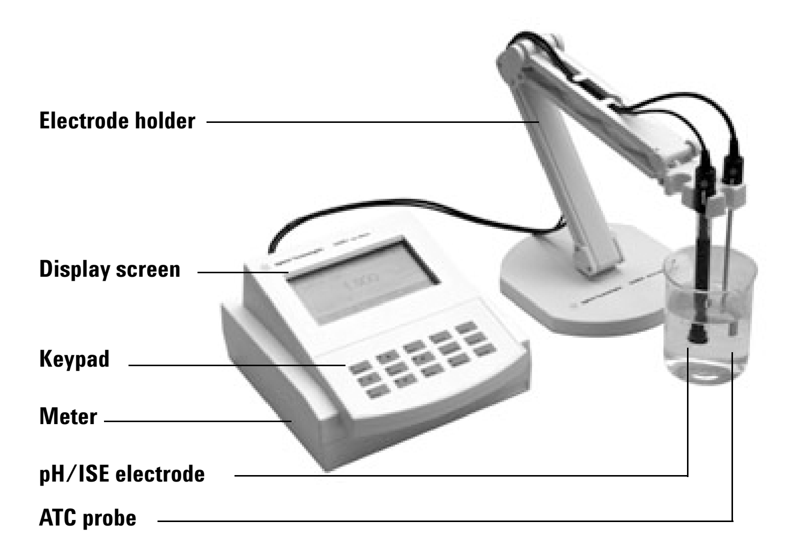


Figure 5 The meter, electrode holder, and probes.

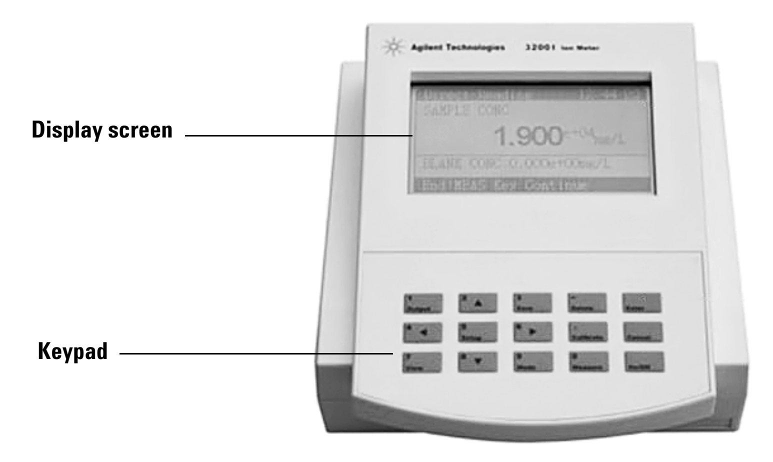


Figure 6 The front view of the 3200I Ion Meter



Figure 7 The back view of the Agilent 3200I Ion Meter

The Display

The display shows the working condition and current setting of the 3200I Ion Meter. The initial state is shown in Figure 8. The left of the screen shows current system time and the right shows current measuring mode, parameters, and the most recent calibration data.

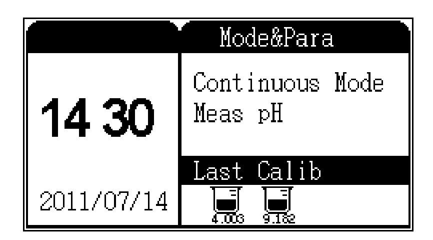


Figure 8 The Initial State display

The Keypad

The keypad has 15 keys. All keys have double functions except for [**Enter**] and [**Cancel**]. Functionality automatically changes based on context. Key functions are listed in the Table 1 on page 23:

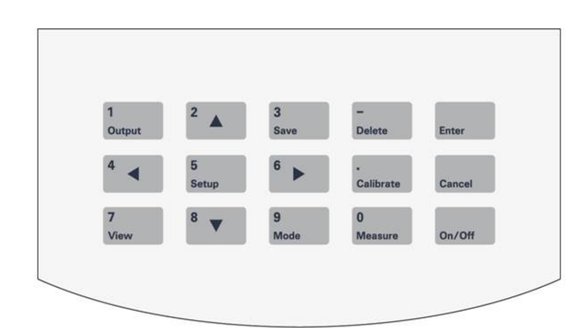


Figure 9 Keypad

Instrument Control

The 3200I Ion Meter is usually controlled by the keypad. Most keys have two functions. Functionality automatically changes based on context. Key functions are listed in the Table 1:

Table 1 Keypad functions

Button	Function 1	Function 2
1 Output	Type the number **1.**	Output data when viewing or calibrating stored data.
2 ▲	Type the number **2.**	Move the selection cursor upward when selecting.
3 Save	Type the number **3.**	Store measurement data.
4 ◀	Type the number **4**.	Move the selection cursor left when selecting.
5 Setup	Type the number **5.**	Opens the Setup menu from the initial screen and also is used as a general "select" button.
6 ▶	Type the number **6.**	Move the selection cursor right when selecting.
7 View	Type the number **7.**	View stored or calibrated data.
8 ▼	Type the number **8.**	Move the selection cursor down when selecting.
9 Mode	Type the number **9.**	Switch the display window or parameter when measuring.

Table 1 Keypad functions (continued)

Button	Function 1	Function 2
0 Measure	Type the number **0.**	Begin measurement.
. Calibrate	Type a decimal point.	Calibrate electrode.
– Delete	Type a negative number.	Delete the data being viewed.
On/Off	Meter power switch.	

Alternately, the 3200I Ion Meter can be controlled through a computer.

Uses for the 3200I Ion Meter

The Ion Meter is suitable for measuring pH, pX and ion concentration of aqueous solutions.

Turn on the Meter

1 Press **[On/Off]** to turn on the meter. When the meter is powered on, the display shows the Agilent name, the meter model, and other information.

2 After the self-check is completed, the display shows the initial state. The display shows the measuring mode, pH parameter, and last calibration data. See Figure 10.

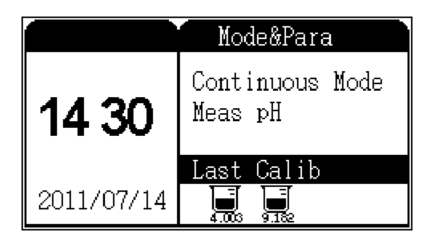


Figure 10 The initial state

Setup

Measuring Mode

This meter supports three measuring modes including **Continuous Mode**, **Timed Reading**, and **Auto-Lock Mode**.

To set the measuring mode:

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11.

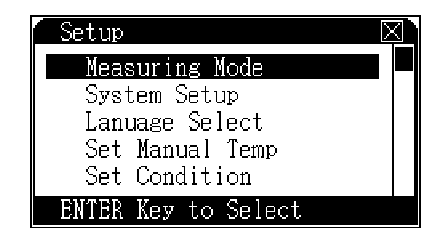


Figure 11 The setup screen

2 Use the directional arrow keys to navigate to **Measuring Mode**.

3 Press [**Enter**] to select **Measuring Mode**. If you need to go back after selecting a menu item, press [**Cancel**] to exit.

4 The **Measuring Mode** screen displays. The left column displays the available measurement parameters pH, pX (ion conductivity), and CONC (ion concentration).

The right column displays the measuring modes for the selected (highlighted) parameter. For most parameters, these are: Continuous Mode, Timed Reading, and Auto-Lock Mode. For ion concentration, these are: Direct Reading, STD Addition, Sample Addition, and GRAN Method.

See Figure 12. Check marks indicate the current selections in use.

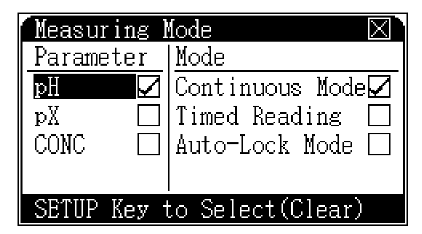


Figure 12 Select a measuring mode

5 Use the arrow keys to highlight the desired parameter and press **[Setup]** to select it. A check appears next to the selected parameter. During measurement, you can still view, save and print the other two parameters. See “To view other parameters during measurement” on page 68.

6 Use the arrow keys to highlight the desired measurement mode for the selected parameter.

7 Press **[Setup]** to enable the mode. See “Descriptions of the modes” on page 28 for more information.

8 Repeat step 5 through step 7 to select or clear all desired parameters and modes.

9 After setting all desired parameters and modes: Press **[Enter]** to save the new setup, exit from setup mode and return to the initial state, or Press **[Cancel]** to exit setup mode without saving changes and return to the initial state.

The new parameters and measuring mode are displayed as shown in Figure 13.

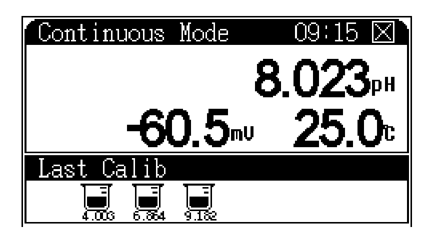


Figure 13 Example measuring mode displayed

Descriptions of the modes

Continuous Mode The meter will simply continue measuring, calculating, and displaying the data. It is up to the user to manually save data or end the measurement.

This is the most frequently used measuring mode. When measurement begins, the meter continuously measures, calculates, and displays the results. You can view the calibrated parameter, calibrate the electrode, save, or print results at any time during measurement. To end a measurement run, press **[Cancel]** followed by **[Enter]**.

Timed Reading The meter will automatically save measurement data periodically while measuring.

When you select Timed Reading, specify a time interval from 1 to 99 minutes. The default time interval is 10 minutes.

When measurement begins, the meter calculates and displays results as it normally does. When the set interval time elapses, the meter automatically stores the data and continues measuring. Data is constantly recorded at the specified time interval.

If the USB interface is connected to a PC, the meter will automatically print the data.

Read about Auto Delete before using this mode. See "Descriptions of the System Setup settings" on page 33.

To end a measurement run, press **[Cancel]** followed by **[Enter]**.

Auto-Lock Mode The meter will stop measuring when recorded values stabilize enough to fall within a set precision and time.

Before performing a measurement in Auto-Lock reading mode, set the Auto-Lock conditions (see “Set Condition” on page 30). When the measurement begins, the meter automatically measures, calculates, and displays the results. Once the measurements meet the preset Auto-Lock condition, the measurement finishes and the screen displays the final readings.

You can view the calibrated parameter, calibrate the electrode, save, or print results at any time during measurement. After measurement, you can save and print the results. Press **[Cancel]** to exit measuring mode or press **[Measure]** to begin the next measurement.

Direct Reading Mode (Direct Reading) This is the most commonly used ion concentration measuring method. When measurement begins, the meter reads, calculates and displays the potential (mV) value. When the reading becomes stable, press [Enter] and the meter calculates the current concentration value. See “Direct Reading mode” on page 52 for details.

Standard Addition Mode (STD Addition) In this mode, the user adds standard solution to the sample. Measure the potential before and after the addition of standard solution. The meter then calculates sample concentration. See “To clear the blank concentration calibration” on page 49 for details.

Sample Addition Mode (Sample Addition) This method is similar to the standard addition method, except that the user adds sample solution to the standard solution. Measure potential variation before and after adding sample solution. See “Sample Addition Mode” on page 57 for details.

GRAN Method The GRAN Method uses multiple additions of standard solution to the sample solution. The user adds a fixed amount of standard solution to the sample repeatedly. Measure the potential after each addition. See “GRAN method” on page 58 for details.

Set Manual Temp

If the meter is connected to an ATC probe, the probe will supply a temperature value. If an ATC probe is not connected to the meter, the user must enter the sample solution temperature manually.

To manually set the sample solution temperature:

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.

2 Use the directional arrow keys to navigate to **Set Manual Temp**.

3 Press [**Enter**] to select **Set Manual Temp** or press [**Cancel**] to exit.

4 The Set Manual Temp screen appears on the display. See Figure 14.

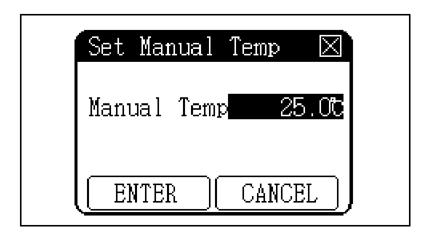


Figure 14 Set Manual Temp

5 With the Manual Temp value highlighted, press [**Setup**] to edit the value.

6 Use the numeric keys to enter a temperature.

7 Press **[Enter]** to save the new setup, exit, and return to the initial state. Press **[Cancel]** to exit without saving changes.

Set Condition

Use **Set Condition** to specify Auto-Lock parameters when measuring in the Auto-Lock measuring mode. An Auto-Lock measurement ends when all measured parameters meet the conditions set on this screen. For example, if **Measure pH** is set to

0.010pH, when the measured pH holds stable within a 0.010pH tolerance for the set Auto-Lock time interval, the measurement ends and the screen displays the final reading.

To set the conditions:

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.
2 Use the directional arrow keys to navigate to **Set Condition**.
3 Press [**Enter**] to select **Set Condition** or press [**Cancel**] to exit.
4 The **Set Condition** screen appears on the display. See Figure 15.

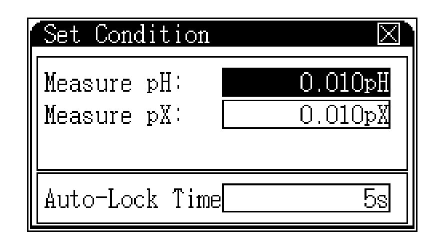


Figure 15 The Set Condition screen

5 Use the arrow keys to select a condition to edit. Press [**Setup**] to edit the value.
6 Enter the desired value. The Auto-Lock time has a range of 1–200 seconds.
7 Press **[Enter]** to save the new setup, exit, and return to the initial state. Press **[Cancel]** to exit without saving changes.

System Setup

The System Setup screen is where the user sets the time on the system clock, sets the calibration interval, and enters the information for the Good Laboratory Practices (GLP) standards.

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.
2 Use the directional arrow keys to navigate to **System Setup**.
3 Press [**Enter**] to select **System Setup** or press [**Cancel**] to exit.

4 The **System Setup** screen appears on the display. See Figure 16.

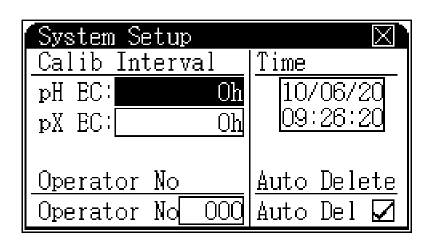


Figure 16 The System Setup screen

5 Use the arrow keys to select a value to edit. Press [**Setup**] to edit the value.

6 Enter the desired value. See "Descriptions of the System Setup settings" on page 33 for more information.

7 If needed, edit the system date and time. To modify the date and time:

a Use the arrow keys to highlight the Time field shown in Figure 16 on page 32 and press **[Setup].**

b The **Set Date & Time** screen opens. This screen displays the current year, month, day, hour, minute, and second (see Figure 17). Press the arrow keys to highlight the proper cell, then press **[Setup]** to select it.

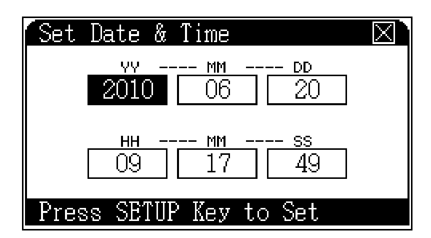


Figure 17 The Set Date & Time screen

c Enter the correct value using the numeric key pad and press [**Enter**].

d Once all changes are made, press [**Enter**] to save the settings and return to the **System Setup** screen.

8 Once all of the system settings are made, press **[Enter]** to save the new setup, exit, and return to the initial state. Press **[Cancel]** to exit without saving changes.

Descriptions of the System Setup settings

Calib Interval is the number of hours between the calibration messages that the Meter periodically displays as a reminder to recalibrate the electrode. The meter begins counting the interval time from when the previous calibration ended. When the calibration interval has elapsed, the meter displays a popup window to remind the user to recalibrate the electrode. A **Calib Interval** value of **0** disables the reminder.

Operator No is a three-digit number from 000–200 used to identify the person operating the meter. The **Operator No** is recorded every time the meter saves data.

When stored data reaches the meter's memory limit **Auto Delete** allows you to automatically overwrite old data with new data. To automatically overwrite old data, select the **Auto Del** checkbox. If **Auto Delete** is not enabled, the meter does not save new data when its memory is full. For example, the meter permits up to 200 sets of data. When you want to store the 201st set of data, if **Auto Delete** is on, meter will delete the first set of data and store the 201st data. If **Auto Delete** is disabled, the new data will not be stored.

CAUTION If **Auto Delete** is disabled, data can be lost.

Language Select

This meter supports Chinese and English languages.

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.
2 Use the directional arrow keys to navigate to **Language Select**.
3 Press [**Enter**] to select **Language Select** or press [**Cancel**] to exit.
4 The **Language Select** screen appears on the display. Use the arrow keys to choose either **Chinese** or **English** and press [**Enter**].

Auto Power Off

The meter can power off automatically after a set time period. To set the **Auto Power Off** time:

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.
2 Use the directional arrow keys to navigate to **Auto Power Off**.
3 Press [**Enter**] to select **Auto Power Off** or press [**Cancel**] to exit.
4 The **Auto Power Off** screen appears. Enter a power off time from 10–480 minutes. Enter a time of 0 to disable **Auto Power Off**.
5 Press [**Enter**].

When the **Auto Power Off** time elapses after the start of a measurement run, the meter shuts off. If the meter is connected to the optional G4390A Electrochemical Data Collecting Software, **Auto Power Off** is disabled.

Set Default

Use **Set Default** to reset the meter to is original factory settings.

1 From the initial state, press [**Setup**]. The setup screen appears. See Figure 11 on page 26.

2 Use the directional arrow keys to navigate to **Set Default**.

3 Press [**Enter**] to select **Set Default** or press [**Cancel**] to exit.

4 The **Set Default** screen appears. Press [**Enter**] to restore parameters to their original settings.

Table 2 Default values for meter parameters

Parameter	Default value
mV Zero	Clears the value. Re-zero before use.
Buffer Group calibrations (NIST standards, DIN standards, GB standards)	Clears all values. The default electrode slope is set to 100% and the E_0 is set to 0.0 mV. Select the desired buffer group before taking measurements.
Other calibration data	Resets to default values
Ion concentration calibration units	mol/L
Ion concentration measuring units	mol/L
current Ion Measuring Method	Na^+
Manual temperature	25.0 °C
Measuring mode	Continuous
Timed Reading Mode interval	10 minutes
Calib Interval	message disabled (0 hours)
Operator No	000
Auto Delete	Enabled
Auto-Lock Set Condition	0.1 pH
pH resolution	0.001 pH
Auto-Lock time	5 s
Auto Power Off	Disabled (0 minutes)

Set Ion Mode

The meter provoffides 10 preset ion modes, used to measure different ion concentrations. To set the meter to measure concentration for a listed ion:

1 If needed, install the appropriate electrode for the desired ion.
2 Press **[Setup]**. The setup screen appears. See Figure 11 on page 26.
3 Select **Set Ion Mode**.

Press **[Enter]** and the meter will display as shown in Figure 18.

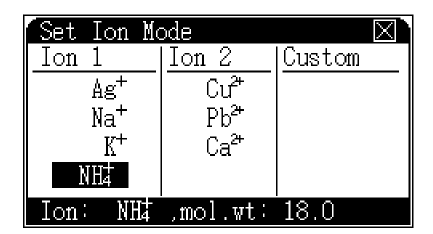


Figure 18 Set ion mode

4 Use the scroll keys to highlight the desired ion. The currently-selected ion name and molecular weight appear at the bottom of the screen.

   Always select the correct ion mode before measurement. An improper choice leads to inaccurate measurements. For example, to measure sodium ion concentration, select **Na^+**.

5 Press **[Enter]** to select the highlighted ion, or press **[Cancel]** to close this screen and return to the initial state.

Regular ions

These ion modes are supplied with the meter: H^+, Ag^+, Na^+, K^+, $NH_4{}^+$, Cl^-, F^-, $NO_3{}^-$, $BF_4{}^-$, CN^-, $Cu_2{}^+$, $Pb_2{}^+$ and $Ca_2{}^+$. Since H^+ is always allowed, it is not displayed in the ion mode.

Custom ions

You can create up to five custom ions (custom ion modes), named **Cus00** to **Cus04**. A custom ion mode requires an ISE electrode capable of measuring the ion.

To create a new custom ion mode:

1 Press **[Setup]** (at the Set Ion Mode screen) to establish a new one. (The meter supplies the name for the mode.)
2 Press **[Enter]** to create the new Custom ion mode.
3 Press **[Setup]**, then select **Amend Ion Mode**.
4 Set the ion valence and molecular weight for this custom ion.
5 Press **[Enter]** to confirm.
6 To delete a custom ion mode, navigate to the Set ion mode screen, then press **[Setup]**. Scroll to Delete Ion Mode then press **[Enter]**.

CAUTION When deleting custom ion modes, all corresponding stored data will be deleted at the same time.

To adjust mV zero

Although the meter compensates for many factors which may affect measurement (such as temperature), it still cannot guarantee zero drift. For accurate measurement, perform **Adjust mV Zero** before measurement.

To check for drift in pH measurement:

1 Turn off the meter.
2 Install the short circuit plug (G4383-40000) into the pH/pX socket.
3 Turn on the meter and let stabilize for 30 seconds.
4 Press **[Setup]**. The setup screen appears. See Figure 11 on page 26.
5 Select **Adjust mV Zero**, and press **[Enter]**. The meter prompts **Adjust mV zero?**.

6 Press **[Enter]** to calibrate a new mV zero. If the potential (mV) value deviates far from zero, double check the short circuit plug connection. Ensure the meter is in zero mV state to avoid an incorrect adjustment.

7 To abort the adjustment, press **[Cancel]**. The meter will return to the measuring state.

To select a pH buffer group

1 View the last pH calibrated data. See “To view calibration data ” on page 47.

2 Press **[Setup]** to enter Group Setup as shown in Figure 19. Figure 19 indicates that the current Buffer Group Setup meets the DIN standard (DIN is checked). The upper area displays the 3 buffer groups and the bottom area displays the buffers included in the selected buffer group.

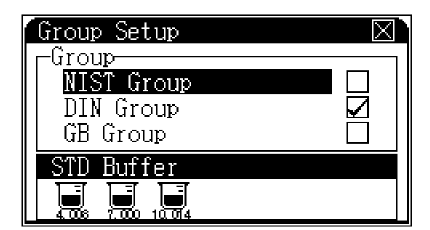


Figure 19 Group setup

3 Use arrow keys to highlight the desired buffer group.

4 Press **[Setup]** to select the highlighted buffer group. (Only one group can be active at a time.)

To select a buffer in a group

After selecting the desired buffer group, select the individual buffers that best correspond to the sample.

To prevent selecting buffers with overlapping pH ranges, select only buffers necessary for measurement and clear selection of other buffers.

1 Verify the current buffer group.
2 Use arrow keys to highlight the target buffer group and press **[Setup]**. The meter shows the buffers available in the group. See Figure 20.

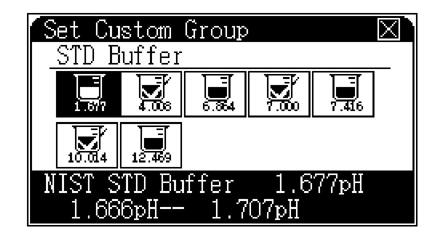


Figure 20 Selecting a buffer for use or calibration (example NIST buffer group shown)

- Icons with √ indicate that a selected buffer.
- Icons without √ indicate an available buffer.
- The bottom part of the display shows the pH value and the range of the highlighted buffer.

3 Use the arrow keys to select (highlight) a buffer.
4 Press **[Setup]** to select or deselect this buffer.

For example, to select the 4.008 pH buffer, use arrow keys to highlight the 4.008 pH icon. Press **[Setup]** to select the icon.

Calibrate the meter to all selected buffers.

About pH buffer groups

The meter provides auto-recognition of several buffer groups prepared according to either the NIST standard, the deionizedN (DIN) standard, or the GB standard. Each group contains several buffers. Using a buffer group simplifies ion calibration. Before measurement, select the buffer solutions most applicable to the sample solution, then calibrate the electrode to those buffers. The meter uses these calibrations to provide accurate results.

Table 3 Buffer groups

Buffer pH	NIST group	DIN group	GB group
1.677	●		
1.680		●	●
3.557		●	
3.559			●
3.775		●	
4.003			●
4.008	●	●	
6.864	●		●
6.865		●	
7.000	●	●	
7.409			●
7.416	●	●	
9.182			●
9.184		●	
10.014	●	●	
12.454		●	
12.460			●
12.469	●		

For each Buffer Group setup, you may select up to five buffers. Since the pH range of a buffer may overlap with the pH range of another buffer in the same buffer group, the meter prevents selecting two or more buffers with overlapping pH ranges.

Prepare Electrodes

To prepare a pH electrode

A new electrode should be stored wet in the storage solution and should be in working condition when received from the factory.

1 Visually check for any mechanical damage. If the storage bottle is dry, soak the electrode in reference filling solution for at least 2 hours before use.
2 Take the storage bottle off and keep it for future use.
3 If there is electrolyte solidified on the measuring tip, rinse it off with distilled or deionized water.
4 Unplug the filling hole.
5 Siphon away the reference solution and add new reference solution. The level of the reference solution must be at least 20 mm higher than the level of sample. The liquid junction must be immersed completely in solution.
6 To guarantee mobility of the reference solution, keep the filling hole open during measurement.
7 Hold the electrode measuring tip downwards and swing it several times to remove air bubbles near the sensitive glass bulb.
8 Connect the electrode to the meter. Put the electrode in the first buffer solution with the measuring tip downwards.

To prepare an ISE electrode

1 Different ISE electrodes need different preparation. Ensure the unused electrode was stored in accordance with the requirements of “Electrode storage” on page 79. If not, soak the electrode in storage solution for at least 2 hours.

2 Take the electrode tip out of its protective sleeve or storage bottle. Preserve them for future use.

3 If there is electrolyte solidified on the outside of the electrode tip, rinse it off with distilled water.

4 Hold the electrode tip downwards and swing it several times to remove any air bubbles from the electrode.

5 If the electrode is refillable, open the filling hole and add filling solution. Fill to at least 20 mm higher than the sample solution level.

6 To guarantee filling solution mobility during measurement, leave the filling hole open.

Calibrate

To calibrate a pH electrode

Before each measurement, we recommend recalibrating the electrode to the series of buffers chosen for the sample. After calibration, any previous calibration data is overwritten.

The meter can perform calibration manually (**Manual config**) or using its auto-recognition feature (**Auto-config**).

- In **Auto-config**, the meter automatically compares the current pH measurement against the selected buffers and assigns the calibration to the correct buffer. If the meter cannot recognize a buffer, it returns a **Calibration error**.
- In **Manual config**, the meter prompts you for the correct buffer pH at the selected temperature.

1 Prepare 1 to 5 buffers. They can be purchased or can be prepared by you. Place them in a constant temperature environment to equilibrate.

2 View the current calibration. See Figure 21. The upper area shows the current pH (in this example the slope is set to 100.00%), potential and temperature value. The bottom area shows the current calibration result.

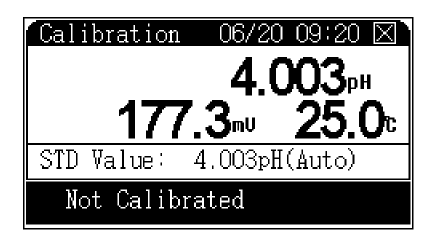


Figure 21 Calibrating the pH electrode

3 Confirm the Buffer Group setup. See "To select a pH buffer group" on page 39 and "To select a buffer in a group" on page 40.

- If you try to calibrate to a buffer that is not selected, it can cause a calibration error or a bad calibration.

4 Press **[Setup]** and scroll to **Set Config Type** to select the recognition method.



Figure 22 Calibration setup

5 Select **Auto-config** or **Manual config**.
   - For regular buffers, use the Auto-Recognition method. Select **Auto-config**.
   - If using a custom pH buffer, select **Manual config**.
   - If using both regular buffers and custom buffers, use both recognition methods. You can calibrate to some buffers, change the buffer selections, then calibrate to another buffer. See “Calibrating custom buffers and buffers with overlapping pH values” on page 47.
6 Clean the pH electrode, reference electrode, and ATC probe. Place them in the calibration buffer. See “To prepare a pH electrode” on page 43.
7 When the reading becomes stable, press **[Enter]**. The meter will display **Storing......** and save the calibration data.
8 After a few seconds, the meter will display a **Continue?** prompt. To calibrate other buffers, select the next buffer to continue. Repeat step 6 and step 7.

At any time during calibration, press **[Cancel]** to end calibration.

The meter supports up to five calibration points. When the fifth buffer is calibrated, the meter prompts to end calibration.

Calibrating custom buffers and buffers with overlapping pH values

For buffers such as 6.864 pH and 7.000 pH which have overlapping pH ranges, try the following:

- When you calibrate t he 6.864 pH buffer, set the buffer group to contain onl y 6.864 pH, then calibrate it. Reset the buffer group to contain only 7.000 pH, then calibrate it.
- Use **Manual config** and manually input the pH of each selected buffer at the selected temperature.

To calibrate an ISE electrode

1 Prepare the electrode for use as described in "To prepare an ISE electrode" on page 44.

2 Install the electrode. See "Installation of electrochemical probes and electrodes" on page 9.

3 Set **pX** as the measurement parameter and set **Continuous Mode**. See "Measuring Mode" on page 26.

4 Press **[Measure]** to start pX measurement.

5 Press **[Calibrate]**, then scroll to and select **Calib pX EC**.

6 Press **[Enter]** to begin the electrode slope calibration. See Figure 23. The upper area shows the current pX (the slope is set at 100.00 %), potential and temperature value. The bottom area shows the current calibration result.

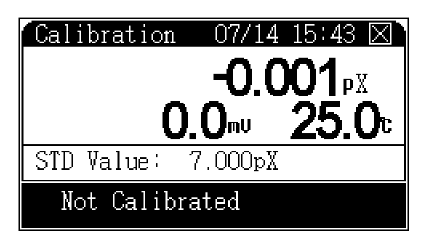


Figure 23 pX calibration

7 Prepare one to five standard solutions.

8 Equilibrate the solutions at the required temperature.

9 Clean the appropriate ISE electrode or reference electrode and ATC probe, and place them in the standard solutions to be calibrated. See “To prepare an ISE electrode” on page 44.

10 Press **[Setup]** and select **Set STD Value**. Manually input the STD pX value of the selected standard solution at the selected temperature.

11 When the reading becomes stable, press **[Enter]**. The meter displays **Storing ...** and saves the calibration data.

12 After a few seconds, the meter displays a **Continue?** prompt.



Figure 24 Storing calibration

13 To calibrate another standard solution, select your new standard solution and press **[Enter]** to repeat the procedure. Continue until all standard solutions are calibrated.

At any time during calibration, press **[Cancel]** to end the process.

To calibrate a blank concentration

Both the direct reading mode and the standard addition mode have a blank calibration. Performing a blank calibration is the same in either mode.

1 Create a blank solution with a similar chemical composition to the sample solution (except for the concentration of the ion measured).

2 Set either **Direct Reading** or **STD Addition**. See “Measuring Mode” on page 26.

3 Press **[Setup]** and Scroll to **CONC Unit**. Select the correct units.

4 Scroll to **Blank CONC** and press **[Setup]**.

5 Put the ISE and the ATC probe in the blank solution. See Figure 25.

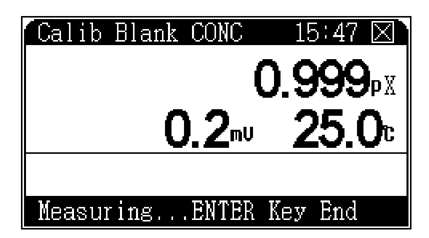


Figure 25 Blank Concentration Calibration in Direct Reading mode

6 When the reading becomes stable, press **[Enter]** and the meter calculates and saves the blank concentration value.

7 Press **[Cancel]** to return to measuring ion concentration in direct reading mode.

To clear the blank concentration calibration

To clear the last blank concentration value:

1 Set either **Direct Reading** or **STD Addition**. See “Measuring Mode” on page 26.

2 Press **[Setup]** and select **Clear Blank CONC**.

Measure

To measure pH value

1 From the initial state display, press **[Setup]**.
2 Select the pH parameter and a measuring mode. See "Measuring Mode" on page 26.
3 If the electrode has not been recently calibrated, calibrate it. See "Calibrate" on page 45.
4 Press **[Measure]** to begin measurement. Figure 26. The upper area of the screen shows the current measuring mode and system time. The central area of the screen shows present pH, potential, and temperature.

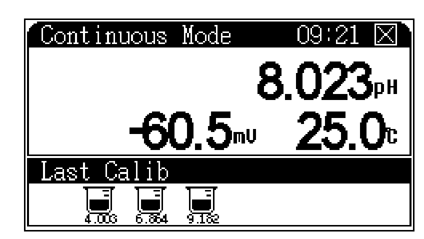


Figure 26 Enter Continuous Mode

5 When measurement begins, adjust mV zero. See "To adjust mV zero" on page 38.
6 During measurement, you can recalibrate the electrode, set parameters and select the pH display resolution.
7 After measurement, press **[Save]** to save data, **[Output]** to output data, or **[Cancel]** to end measurement.

To measure mV

The current pH and mV values are always shown when measuring.

To measure temperature

The current temperature is always shown when measuring.

To measure pX

With a recently-calibrated ISE installed, you can begin measurements.

1 From the initial display, ensure the measured parameter is pX. If not, select pX measurement as described in "Measuring Mode" on page 26.

2 Check the current ion mode. See "Set Ion Mode" on page 37.

3 Adjust mV zero. See "To adjust mV zero" on page 38.

4 If the ISE is not calibrated, prepare and calibrate the ISE before use. See "To calibrate an ISE electrode" on page 47.

5 Press **[Measure]**. See Figure 27. During measurement, you may recalibrate the electrode and set parameters.

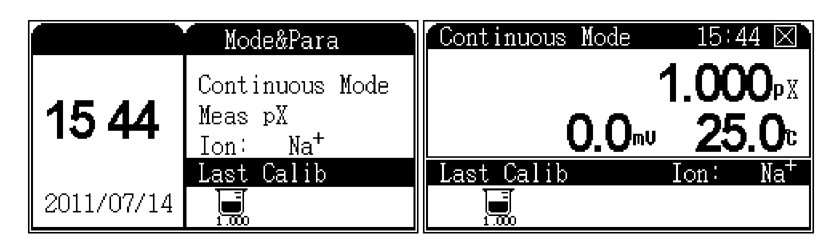


Figure 27 pX measurement

6 After measurement, you can press **[Save]** to save measurement data, **[Output]** to print data, or **[Cancel]** to end measurement.

To measure ion concentration

There are four concentration measurement modes:

- Direct Reading of Concentration Mode (**Direct Reading**)
- Standard Addition Mode (**STD Addition**)
- Sample Addition Mode (**Sample Addition**)
- GRAN Method (**GRAN Mode**)

Direct Reading mode

The Direct Reading mode uses the following Nernst formula to calculate the concentration:

$$E_x = E_0 + S[\log(C_x + C_b)]$$

In which:

E_x = Equilibrium potential of sample

E_0 = Zero potential, potential for ion activity = 1

S = Electrode slope

C_x = Concentration value of sample

C_b = Blank concentration value

Obtain slope and zero potential through slope calibration. Calibrate the blank concentration also. Then measure concentration of the sample directly.

To measure concentration in Direct Reading mode:

1. Select **CONC** as the parameter and select **Direct Reading** as the mode. See “Measuring Mode” on page 26.
2. Select the ion mode that matches the ISE (ion selective electrode) type. For instance, to measure Ag^+ concentration, select the **Ag^+** mode. See “Set Ion Mode” on page 37.
3. From the initial screen, press **[Measure]**. See Figure 28. During measurement, you can view calibrated data, calibrate the electrode, adjust mV zero, calibrate blank concentration, and reset blank concentration.

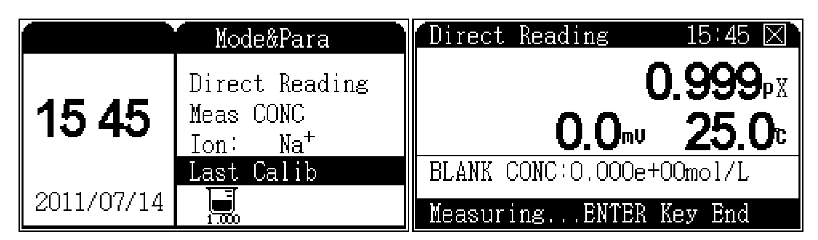


Figure 28 Direct Reading mode

- The upper left area shows current system time, potential, temperature, and pX value. The bottom area shows current measuring result and blank concentration value.

4 If necessary, perform a blank concentration correction. See “To calibrate a blank concentration” on page 48.

5 Rinse the ISE thoroughly and put it in sample solution. The meter displays current measurement data.

6 When the reading becomes stable, press **[Enter]** and the meter calculates measurement result as shown in Figure 29.

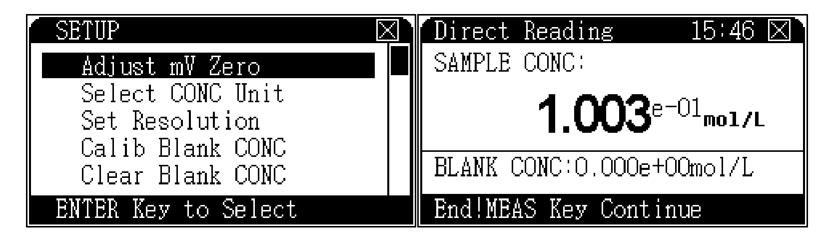


Figure 29 Calculated result

7 After measurement, you can press **[Save]** to save measurement data, **[Measure]** to perform another ion concentration measurement, **[Setup]** to select the proper concentration unit, **[Output]** to print data, or **[Cancel]** to end measurement.

Standard Addition Mode (STD Addition)

Standard Addition Mode is also called “known addition mode”. First, measure the potential of the sample solution after the reading becomes stable. Then add standard solution of known concentration to the sample. Measure the potential again after the reading becomes stable. Calculate the sample concentration through the change in potential using the formula:

$$C_x = \frac{\rho \times C_s}{(1+\rho) \times 10^{(E_2 - E_1)/S} - 1} + \frac{\rho \times C_b}{(1+\rho) \times 10^{(E_{b2} - E_{b1})/S} - 1}$$

In which:

C_x = Concentration value of sample to be measured

C_s = Concentration value of STD solution (add solution)

S = Slope of electrode

C_b = Blank STD concentration value

E_1 = Potential value of the system before adding solution

E_2 = Potential value of the system after adding solution

ρ = Ratio of added volume of the standard solution (V_s) to volume of the sample to be measured (V_x)

E_{b1} = Potential value of the system before adding solution when calibrating blank

E_{b2} = Potential value of the system after adding solution when calibrating blank

To measure concentration in STD Addition mode:

1 Select **CONC** as the parameter and select **STD Addition** as the mode. See “Measuring Mode” on page 26.

2 Select the ion mode. See “Set Ion Mode” on page 37.

3 Press **[Measure]**. The meter enters standard addition mode as shown in Figure 30.

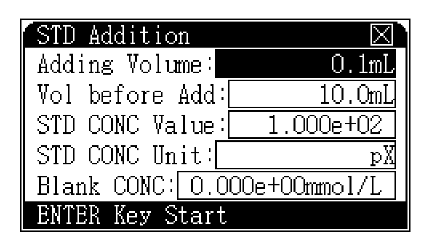


Figure 30 Standard Addition mode

4 Input the required information. Use the arrow keys to select each parameter. Press **[Setup]** to modify the parameter or to calibrate the blank concentration (if **Blank CONC** is selected).

Adding Volume Addition volume. The standard solution volume to be added.

Vol before Add The sample volume before adding any standard.

STD CONC Value Standard solution concentration

STD CONC Unit Standard solution concentration unit

Blank CONC Blank concentration value. See "To calibrate a blank concentration" on page 48.

5 After setup, rinse the ISE electrode thoroughly and put it in the sample solution.

6 Press **[Enter]** to perform the standard addition measurement. The meter displays current potential, temperature and pX value. See Figure 31.

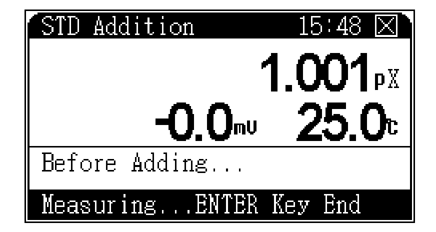


Figure 31 Before adding

7 When the reading becomes stable, press **[Enter]** to save this potential. The meter displays **STD Addition**.

8 Add the correct volume of standard solution and mix.

9 When the reading becomes stable, press **[Enter]**. The meter prompts to end the process and shows the calculated sample concentration. See Figure 32.

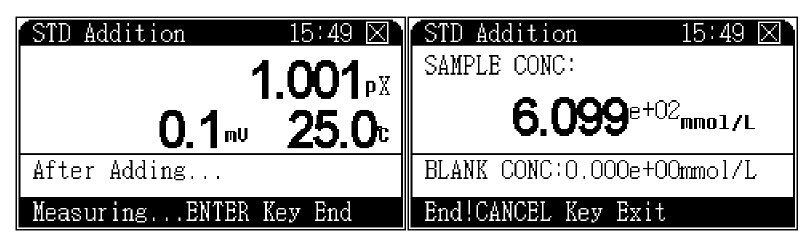


Figure 32 Final screen

10 After measurement, you can press **[Save]** to save measurement data, **[Output]** to print data, or **[Cancel]** to end measurement.

Sample Addition Mode

This mode is similar to the standard addition mode, except that the solution is added to the standard. The meter calculates the concentration from the formula:

$$C_x = C_s \times [(1 + \rho) \times 10^{(E_2 - E_1)/S} - \rho]$$

In which:

C_x = Concentration value of sample to be measured (add solution)

C_s = Concentration value of STD solution

ρ = Volume of STD solution (V_s)/volume of sample to be measured (V_x)

E_1 = Potential value of the system before adding measured sample

E_2 = Potential value of the system after adding measured sample

S = Slope of electrode

To measure concentration in Sample Addition mode:

1 Select **CONC** as the parameter and select **Sample Addition** as the mode. See “Measuring Mode” on page 26.

2 Select the ion mode. See “Set Ion Mode” on page 37.

3 Press **[Measure]**. The meter enters sample addition mode as shown in Figure 33.

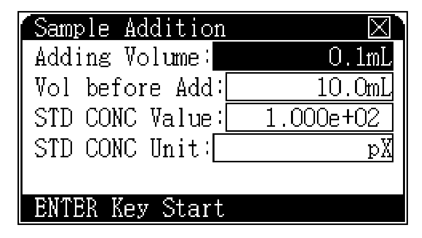


Figure 33 Sample Addition

4 Input the required information. Use the arrow keys to select each parameter. Press **[Setup]** to modify the parameter or to the calibrate blank concentration (if **Blank CONC** is selected).

5 After setup, rinse the ISE electrode thoroughly and put it in the sample solution.

6 Press **[Enter]** to perform the sample addition measurement. The meter displays current potential, temperature and pX value.

7 When the reading becomes stable, press **[Enter]** to save this potential. The meter displays **Sample Addition**.

8 Add the correct volume of sample solution and mix.

9 When the reading becomes stable, press **[Enter]**. The meter prompts to end the process and shows the calculated sample concentration.

GRAN method

The meter supports the GRAN method for measuring samples with low concentration. Solve for C_x, using this equation:

$$(V_s + V_x) \times 10^{(E)/S} = 10^{(E_0)/S} \times (C_x \cdot V_x) + 10^{(E_0)/S} \times (C_s \cdot V_s)$$

Operation is similar to standard addition mode.

1 Select **CONC** as the parameter and select **GRAN Mode** as the mode. See “Measuring Mode” on page 26.

2 Select the ion mode. See “Set Ion Mode” on page 37.

3 Press **[Measure]**. The meter enters GRAN mode.

4 Input the concentration (C_s) and volume (V_s) of the STD solution and the volume (V_x) of the sample.

5 Measure the electrode potential value of the sample after the standard solution is added.

6 Repeat the measurement 3 to 8 times. The meter calculates the concentration of the sample.

Managing Data

To save data

The Meter can save 200 sets of pH data. The procedure to save data varies with different measuring modes.

- In continuous mode and Auto-Lock reading mode, press **[Save]** to save data when readings become stable.
- In timed reading mode, you can still save data manually, but the meter automatically saves measuring data at a fixed periodic time interval. See "Measuring Mode" on page 26.

To delete data

You can delete individual data entries or delete all data at once.

1 In either the initial screen or while measuring, press [**View**].

2 Select the data and press [**Delete**].

To output data

There are two ways to output current measurements, calibration data, and saved data.

If using the optional G4390A the data collecting software with the meter, the software can collect the data, print it, and so forth.

If not using the optional G4390A software, install the optional data printing software. See "Installing the Optional Software" on page 14.

To view data

The Agilent 3200I Ion Meter allows you to view parameters such as the last calibration data and current parameter. It also allows you to set the parameter directly and view saved data. The

meter stores data according to the parameter measured. All saved data meets GLP standards. The meter can store 200 sets of data.

1 In the initial state, press **[View]**.

2 Navigate to the type of data to view and press **[Enter]**. See Figure 34.



Figure 34 Viewing data

To view saved pH data (View Saved pH)

1 In the initial state, press **[View]**.

2 Navigate to **View Saved pH** as shown in Figure 35. The upper area displays the current viewing mode and actual stored amount.

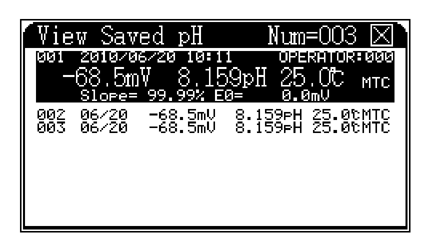


Figure 35 Viewing saved pH data

Each page can display 10 saved data at most. The data includes saved time and operator No. Use arrow keys to view each saved data. Press **[Output]** to print data or press **[Delete]** to delete data.

The output format follows:

```
========================
MODEL
```

```
               3200I
           ION METER
SOFT VERSION
            VER 1.00
PRINT TIME
            10:25:42
          2010/06/20
OPERATOR NO
                 000
************************
STORED NUM:      003
************************
              NO:001
OPERATOR NO:     000
STORED TIME: 10:19:00
          2010/06/20
SLOPE:       100.00%
E0:          -0.0mV

POTENTIAL:     0.0mV
pH:          7.000pH
TEMP:          25.0c
TC.TYPE:         MTC
************************
              NO:002
OPERATOR NO:     000
STORED TIME: 10:19:00
          2010/06/20
SLOPE:       100.00%
E0:          -0.0mV

POTENTIAL:     0.0mV
pH:          7.000pH
TEMP:          25.0c
TC.TYPE:         MTC
************************
              NO:003
OPERATOR NO:     000
STORED TIME: 10:19:00
          2010/06/20
SLOPE:       100.00%
E0:          -0.0mV

POTENTIAL:     0.0mV
pH:          7.000pH
```

```
TEMP:                 25.0c
TC.TYPE:                MTC
========================
```

To view saved pX data (View Saved pX)

The meter saves data according to the ion mode. Each ion mode can save 100 sets of pX data and 100 sets of ion concentration data. Since the meter can save data from six different ion modes, there are 600 sets of pX data and 600 sets of ion concentration data.

1 In the initial state, press **[View]**.
2 Navigate to **View Saved pX** as shown in Figure 36. The upper area displays the current viewing mode and actual stored amount.

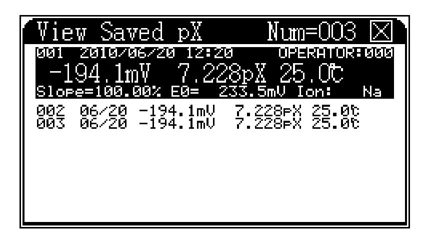


Figure 36 Viewing saved pX data

3 Press **[Output]** to print data or press **[Delete]** to delete data.

The meter supports six ion modes at once. To view saved data in other ion modes, press **[Setup]** (or **[Mode]** or **[View]**) to change to other ion modes. The meter will ask **View Other Ion?** Press **[Enter]** to view data of other ion modes. Figure 37 shows **View Na^+** ion mode is changed to **View Ag^+** ion mode in **View saved pX**.

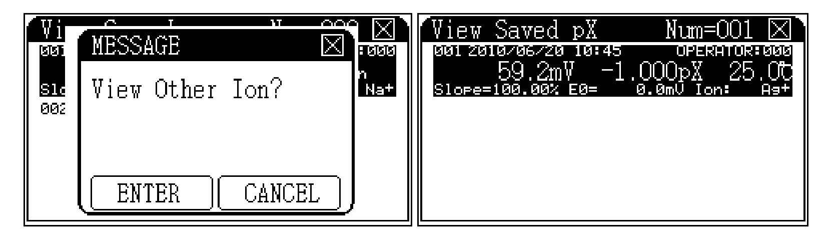


Figure 37 Changing ion

Press **[Output]** to print data or press **[Delete]** to delete data.

The output format follows:

```
========================
MODEL
                   3200I
              ION METER
SOFT VERSION
                VER 1.00
PRINT TIME
                10:26:23
              2010/06/20
OPERATOR NO
                     000
************************
STORED NUM:          003
************************
                  NO:001
OPERATOR NO:         000
STORED TIME:    10:34:00
              2010/06/20
SLOPE:           100.00%
E0:              118.3mV

POTENTIAL:        59.2mV
pX:              1.000pX
TEMP:              25.0c
ION NAME:             Na
************************
                  NO:002
OPERATOR NO:         000
STORED TIME:    10:34:00
              2010/06/20
```

```
SLOPE:              100.00%
E0:                 118.3mV

POTENTIAL:           59.2mV
pX:                 1.000pX
TEMP:                 25.0c
ION NAME:                Na
************************
                    NO:003
OPERATOR NO:            000
STORED TIME:       10:34:00
                 2010/06/20
SLOPE:              100.00%
E0:                 118.3mV

POTENTIAL:           59.2mV
pX:                 1.000pX
TEMP:                 25.0c
ION NAME:                Na
========================
```

To view saved CONC data (View Saved Ion Concentration)

This is very similar to **View Saved pX.**

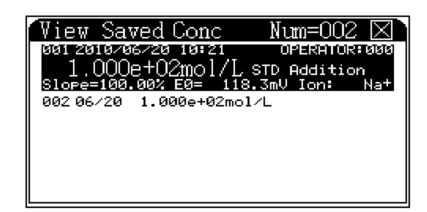


Figure 38 View saved ion concentration

View pH calibration data (View pH Last Calib)

1 In the initial state, press **[View]** and select **pH Last Calib**.

2 Press [**Enter**] to view last calibrated pH data as shown in Figure 39.

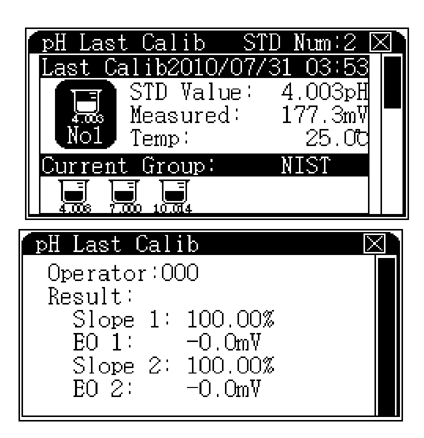


Figure 39 Viewing pH calibration data

The upper area shows the last calibrated data. The bottom area shows the current buffer groups. Use the arrow keys to view detailed calibrated data. To print current parameter data, connect to a PC with USB and press **[Output]**.

The output format follows:

```
========================
MODEL
                   3200I
               ION METER
SOFT VERSION
                VER 1.00
PRINT TIME
                10:11:27
              2010/06/20
OPERATOR NO
                     000
************************
PH CALIB DATA
CALIB TIME:     08:12:00
```

```
                2008/06/01
OPERATOR NO:           000

                   POINT 1
pH:                4.003pH
POTENTIAL:         177.3mV
TEMP:                25.0c
************************
                   POINT 2
pH:                6.864pH
POTENTIAL:           8.0mV
TEMP:                25.0c
************************
                   POINT 3
pH:                9.182pH
POTENTIAL:        -129.1mV
TEMP:                25.0c
************************
CALIB RESULT
SLOPE 1:           100.00%
E0 1:               -0.0mV
SLOPE 2:           100.00%
E0 2:               -0.0mV
========================
```

View pX calibration data (View pX Last Calib)

1 In the initial state, press **[View]** and select **pX Last Calib**.

2 Press **[Enter]** to view calibrated data in current ion mode. See Figure 40.

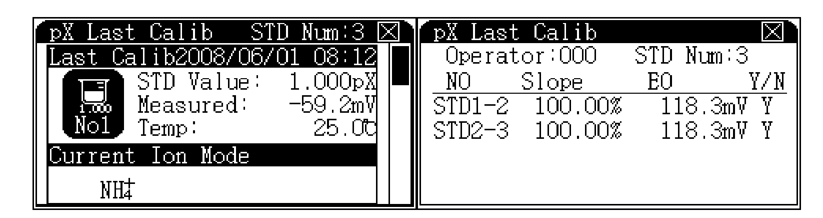


Figure 40 pX Last Calib

3 Press arrow keys to view detailed calibrated data, or press **[Setup]** to set new ion mode and print calibrated data.

Press **[Output]** to print data or press **[Delete]** to delete data.

The output format follows:

```
========================
MODEL
                   3200I
              ION METER
SOFT VERSION
               VER 1.00
PRINT TIME
               10:23:44
             2010/06/20
OPERATOR NO
                    000
************************
PX CALIB DATA
CALIB TIME:    08:12:00
             2008/06/01
OPERATOR NO:        000
ION NAME:            Na

                POINT 1
pX:             1.000pX
POTENTIAL:       59.2mV
TEMP:             25.0c
************************
                POINT 2
pX:             5.000pX
POTENTIAL:     -177.5mV
TEMP:             25.0c
************************
                POINT 3
pX:             7.000pX
POTENTIAL:     -295.8mV
TEMP:             25.0c
************************
BLANK CONC:
CONC:     0.000e+00mol/L
************************
CALIB RESULT
SLOPE 1:        100.00%
E0 1:           118.3mV
SLOPE 2:        100.00%
E0 2:           118.3mV
========================
```

To view other parameters during measurement

You can view other parameters during a measurement, even if you did not select them during setup. To view other parameter values during a measurement:

1. Press [**Mode**] and the display will highlight the measuring window. Press [4/◀] or [6/▶] repeatedly to switch parameters. When you stop pressing [4/◀] or [6/▶] for more than a few seconds, the meter automatically returns to the normal measuring mode display.
2. Press [**Output**] to print or press [**Save**] to save displayed values.

To Turn Off the 3200I Ion Meter

After using the meter, press **[Save]** to save the data, then press **[On/Off]** to turn off the meter. When not in use, all electrodes should be soaked in distilled water. If the meter is out of use for a long time, pay attention to:

1. Disconnect power adaptor to avoid damage to the analyzer and the power supply.
2. Keep the socket of the meter clean and dry. Do not allow the meter to contact acid, alkaline, or salt solutions.
3. If the meter is out of use, insert the short circuit plug in the back of the meter to prevent damage to the open circuit.
4. After measurement, store the electrode in reference filling solution. For refillable electrode, plug the filling hole. If the electrode will be out of use for a long time, put it back in the box and store it at ambient temperature.

Software Operation

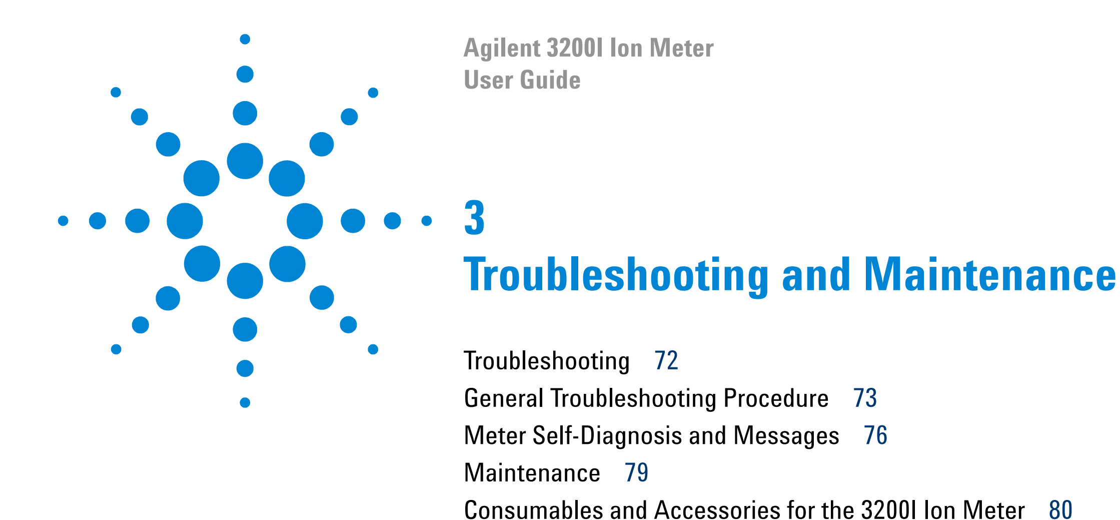
See also "Installing the Optional Software" on page 14.

To use the optional G4390A Electrochemical Data Collecting software

1. Connect the meter to the power adapter.
2. Press **[On/Off]** to turn on the meter.
3. Connect the meter to the computer using the USB cable.
4. Run the Electrochemical Data Collecting Software in the computer and the software will recognize the meter model and type. The software provides the functions corresponding to the meter type. Refer to the software documentation for details.

To use the Data Printing software

1. Connect the meter to the power adapter.
2. Press **[On/Off]** to turn on the meter.
3. Connect the meter to the computer using the USB cable.
4. Launch the printing software.
5. With the meter taking measurements or when viewing calibration data or stored data, press **[Output]**. The software receives the data. Once received, print the data as desired. For details, refer to the Data Printing software documentation.



3
Troubleshooting and Maintenance

This chapter describes how to verify whether the meter is working properly and how to maintain the meter.

Troubleshooting

If the meter is not working properly during operation, perform trouble-shooting according to the following table.

Table 4 Troubleshooting

Number	Failure mode	Failure cause	Solutions
1	No display after meter starts up LCD display is not lighting.	**1** Incorrect installment of power adaptor. **2** The power supply does not meet with the requirements. **3** Power adaptor is damaged. **4** The power socket has a poor contact. **5** LCD is damaged (After start up for a few minutes, user can hear buzzing sound after pressing **[On\Off]** but there is no display on LCD.)	**1** Connect it again according to the instructions. **2** Use an approved power supply. **3** Replace the power adaptor. **4** Check all connections for good contact.
2	No buzzing when pressing key.	**1** You may have pressed invalid keys under current setup. **2** The buzzer has been damaged.	The buzzer only sounds when you press a valid key.
3	No response when pressing key.	**1** You may have pressed invalid keys under current setup. **2** The key has been damaged.	Press the valid key for operation.
4	Meter does not display 25 °C when no ATC electrode is connected with meter.	When the meter is not connected with an ATC electrode, the meter will automatically switch to manual temperature setting.	Manually input temperature.
5	The reading is not stable after a long time.	**1** The electrode has been damaged or aged. **2** There is strong electrical signal interference source nearby (electrical leaking, strong electromagnetic field, and so forth).	**1** Replace the electrode. **2** Remove the electrical signal interference source. Lift or move the beaker away from the source of interference. Shield the meter and beaker from the electromagnetic field. Use a wire to connect the meter with a ground line. For the wire, one terminal is connected with the meter and the other terminal is connected with interference source.

General Troubleshooting Procedure

During the use of the meter, there are many factors that may affect the measurement, including the electrode, the standard solutions used to calibrate electrode, the sample solution, the temperature during measurement, incorrect operation, or use, and so forth. When the measured results are significantly different from what was expected, first determine whether the meter itself or factors other than the meter caused the error. Follow the suggestions described below to diagnose the problem. Since there are multiple measuring methods, you will need to diagnose the meter based on your application conditions.

Diagnose whether the errors are caused by meter hardware, electrode calibration data error, parameter errors, or other errors, including the sample solution, solution preparation, buffer solutions used for calibration, and so forth.

For factors other than the meter, compare measurement results between known solutions. Put the electrode in different standard solutions. Based on the comparison, judge whether the deviation is resulted from the electrode, the solution, or something else.

Check the temperature measurement

Because temperature measurements are used for all measurements and calculations, always ensure temperature measurement is functioning well.

Connect the meter to the ATC temperature diagnostic tool (5185-8390) shipped with the meter. Turn on the meter to enter into measurement state. With the ATC temperature diagnostic tool connected, the meter should display a temperature reading between 49.0 to 51.0 °C. If yes, the meter is correctly measuring temperature. If the meter displays a temperature reading significantly different from 50 °C, there is a problem with the meter. Contact Agilent service.

Restore factory default settings

If other troubleshooting does not solve the problem, you can restore the meter to the factory default settings. This clears all user calibrations and settings so that you can verify that an erroneous calibration or setting is not the cause of the problem. After restoring the factory default settings, retest the meter.

See “Set Default” on page 36.

Troubleshoot ion measurement

Check the potential (mV) value

1 Disconnect the ISE electrode.
2 Connect the meter to the short circuit plug (G4383-40000) shipped with the meter.
3 Turn on the meter.
4 Start measuring pH.

At this moment, the meter should display a potential (mV) reading between -0.5 to 0.5 mV (also called mV Zero). If yes, this indicates that the meter is functioning properly. If the potential (mV) reading significantly deviates from zero, then use the Adjust mV Zero function to adjust mV Zero. (see “To adjust mV zero” on page 38) After adjustment, the potential (mV) reading should be near to zero. If the potential value (mV) reading cannot be adjusted near to zero by the mV Zero adjustment, this indicates a problem the meter. Contact Agilent service.

Check the pH value

Disconnect the ATC probe. Set the meter for manual temperature input. Manually set the temperature to 25 °C. When the potential (mV) is zero, the meter should display a pH reading between 6.99 to 7.01 pH. If yes, this indicates the electrode calibration data of the meter is acceptable. If not, there may be a problem with the electrode calibration data. Check the slope of electrode. Press **[View]**, select **Last pH Calib**, and press **[Enter]**. Now, view the calibration data and slope from

last calibration. If the calibration data is severely out of the measurement requirement (the meter displays error message—refer to “Error warning messages” on page 76), this indicates a problem in the last electrode calibration which may lead to a large measurement error. Recalibrate the electrode. Pay attention to the selection of the Buffer Group during calibration.

NOTE

In the measurement state, the meter may display an error message simultaneously with measurement data.

Check the pX value

If user observes a large deviation in pX measurement, the deviation in pX measurement may be related to the stirring rate and reagents used to adjust ionic strength. This procedure can only diagnose the meter. To diagnose other factors, refer to professional application notes.

To diagnose the meter, first check the temperature measurement (see “Check the temperature measurement” on page 73). Next check the potential measurement (see “Check the potential (mV) value” on page 74), and then the pH value measurement (see “Check the pH value” on page 74).

For factors other than the meter, compare standard versus sample solutions to determine the cause of the problem. Put the electrode in different standard solutions and sample solutions. Check the corresponding potential (mV) value, pH or pX value. Based on the comparison, judge whether the deviation results from the electrode, the solution, or something else.

Meter Self-Diagnosis and Messages

The meter supports self-diagnosis, which can find some common errors caused by the meter, electrode/probe, solution or operation. It will deal with these errors differently according to their severity. There are two levels of severity: **Severe system errors** hinder further use of the meter or make the meter unable to finish necessary tasks. In this case, replacement or maintenance of the meter is required.

Minor errors, which are prompts or warnings, are caused by various reasons and can be corrected in several ways. However, you must pay attention to these errors to ensure measurement integrity and reliability. If you ignore these error messages, operation can continue.

Severe errors

When severe errors occur, the meter will shut down and display a prompt window. In this case, you cannot do any further operation except turn off the meter. The meter will display an error message as shown in Figure 41.

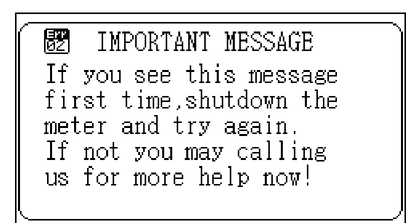


Figure 41 Severe error message

Error warning messages

User should pay attention to messages or warnings resulting from an improper electrode/probe, solution, or operation. Read these error messages carefully. Maintain and operate the meter and electrode according to their instructions to minimize the occurrence of such errors.

Figure 42 shows a warning that the temperature is out of range.

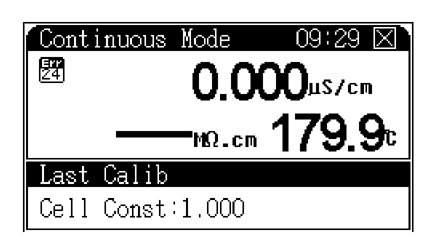


Figure 42 Temperature warning

Err 24 is the icon for an error warning. The icon includes the error code. See Table 5.

Table 5 Error warning codes

Code	Description	Solution	Memo
00	Conductivity measuring module error	Contact Agilent for service.	Serious error
01	DO measuring module error	Contact Agilent for service.	Serious error
02	Temperature measuring module error	Contact Agilent for service.	Serious error
03	Data storage error	Contact Agilent for service.	Serious error
20	Potential is out of range	Replace electrode.	–1999.9 to 1999.9 mV
21	pH/pX is out of range	Replace electrode.	–3.000 to 21.000 pH
22	Conductivity is out of range	Replace probe and solution.	0 to 2000 mS/cm
23	Resistivity is out of range	Replace probe and solution.	0 to 100 MΩ• cm
24	Temperature is out of range	Replace electrode and decrease solution temperature.	–6.0 to 120.0 °C
25	DO electric current is out of range	Replace probe.	0 to 4000 nA
26	pH electrode slope is out of range	Replace electrode and recalibrate it.	80 to 120%
27	Failed to recognize pH buffers	Replace electrode, setup proper buffer group and replace buffers.	

Table 5 Error warning codes (continued)

Code	Description	Solution	Memo
28	Temperature of pH buffer is out of range	Cool or heat buffer.	
29	Calibrate the same buffer repeatedly	Replace the buffer.	Due to incorrect operation
30	Number of pH buffers exceeds maximum.	Remove one or more buffers from the group.	
31	pH buffers conflict with each other	Remove one or more buffers with overlapping pH values.	
32	The data storage is full.	Overwrite the previous data and store new data.	Do not delete all data
33	The internal clock has a low battery.	Set time manually.	
34	Number of customer-defined ions exceeds maximum	Delete one or more unnecessary customer-defined ions.	
35	The maximum ion mode number stored	Delete all storage data of certain ion mode.	

Maintenance

Electrode cleaning

General electrode cleaning includes inorganic cleaning, organic cleaning, grease cleaning, protein precipitation cleaning and glass sensitive membrane regeneration. The type of cleaning needed depends on the contaminants and the electrode. After one or more cleaning procedures, rinse the outside of the electrode with distilled water. Siphon the filling solution away and add fresh solution. Repeat 2 or 3 times. Store the pH electrode in the storage solution.

Electrode storage

pH measuring electrode

When the electrode is not in use, store it in reference filling solution. For refillable electrodes, plug the filling hole. When the electrode is not used for a long time, put the electrode back in the box and store it a dry place at ambient temperature.

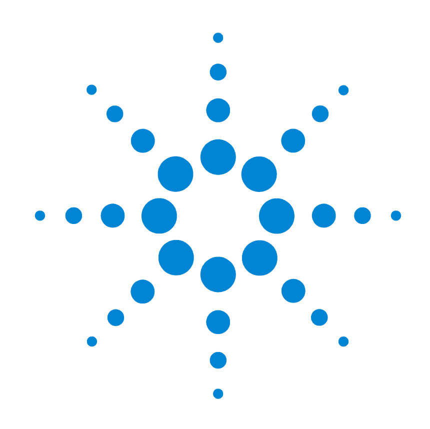
Consumables and Accessories for the 3200I Ion Meter

Table 6 Consumables and accessories for 3200I Ion Meter

Order No.	Model and Name	Description
G4388A	3200SA Stirrer	Electrode holder and magnetic stirrer: combined to stir solution with stable and precise speed with a large adjustable range.
G4389A	3200EA Electrode Holder	It is used to fix different electrodes.
5185-8389	AC Adaptor	100/240 VAC, 1 A, 50/60 Hz
G4383-40000	Short Circuit Plug	Zero potential calibration and diagnostication.
G4388-27000	Stirring Bar	It is used with stirrer.
5190-4002	I9111 Fluoride Combination ISE	Combination Electrode, plastic body and refillable.
5190-4004	I9121 Ammonia Combination ISE	Combination Electrode, plastic body and refillable.
5190-4005	I9131 Sodium Combination ISE	Combination Electrode, glass body and refillable.
5190-3988	P3211 pH Combination Electrode	Combination Electrode, glass body and refillable.
5190-3989	P3212 pH Combination Electrode	Combination Electrode, plastic body and sealed
5190-3990	P3311 pH Triode Combination Electrode	Triode Combination Electrode with built-in ATC probe, glass body and refillable
5190-3991	P3111 pH Electrode	Glass body and single electrode
5190-3992	P3213 pH Combination Electrode	Combination Electrode, plastic body, flat sensitive glass membrane and refillable
5190-3993	P3214 pH Combination Electrode	Combination Electrode, plastic body, spear-tip sensitive glass and sealed
5190-4003	R8111 Reference Electrode	Glass body, Ceramic junction, Ag/AgCl and single-junction
5190-3999	ORP8211 ORP Electrode	Combination Electrode, glass body and refillable
5190-3998	T7111 ATC Probe	Stainless Steel body Measuring Range: 0 to 100
5190-0533	pH Buffer Pouches	Bottle, 3 X 250 mL, 4.01, 7.00, 10.01 pH
5190-0534	pH Buffer Pouches	Bottle, 3 X 250 mL, 4.00, 6.86, 9.18 pH

Table 6 Consumables and accessories for 3200I Ion Meter (continued)

Order No.	Model and Name	Description
5190-0541	pH 1.68 Buffer	Bottle, 3 X 250 mL
5190-0538	pH 4.00 Buffer	Bottle, 3 X 250 mL
5190-0535	pH 4.01 Buffer	Bottle, 3 X 250 mL
5190-0539	pH 6.86 Buffer	Bottle, 3 X 250 mL
5190-0537	pH 7.00 Buffer	Bottle, 3 X 250 mL
5190-0540	pH 9.18 Buffer	Bottle, 3 X 250 mL
5190-0536	pH 10.01 Buffer	Bottle, 3 X 250 mL
5190-0542	pH 12.46 Buffer	Bottle, 3 X 250 mL
5190-0546	Reference solution	Bottle, 3 X 30 mL
5190-0543	Sodium ISE Reference solution	Bottle, 3 X 30 mL
5190-0544	Ammonia electrode membrane kit	5 pcs



Agilent 3200I 离子计

用户手册



声明

手册部件号

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安全声明

小心

小心提示表示存在危险。提醒您注意某个操作步骤、某项操作或类似问题，如果执行不当或未遵照提示操作，可能会损坏产品或丢失重要数据。只有完全理解并符合指定的条件时，才可以忽略小心提示的要求继续进行操作。

警告

警告提示表示存在危险。提醒您注意某个操作步骤、某项操作或类似问题，如果执行不当或未遵照提示操作，可能会导致人身伤害或死亡。只有完全理解并符合指定的条件时，才可以忽略警告提示的要求继续进行操作。

目录

1
3200I 型离子计安装指南

本安装过程，要求使用随 3200I 型离子计附带的配件。



安装所需的工具和部件

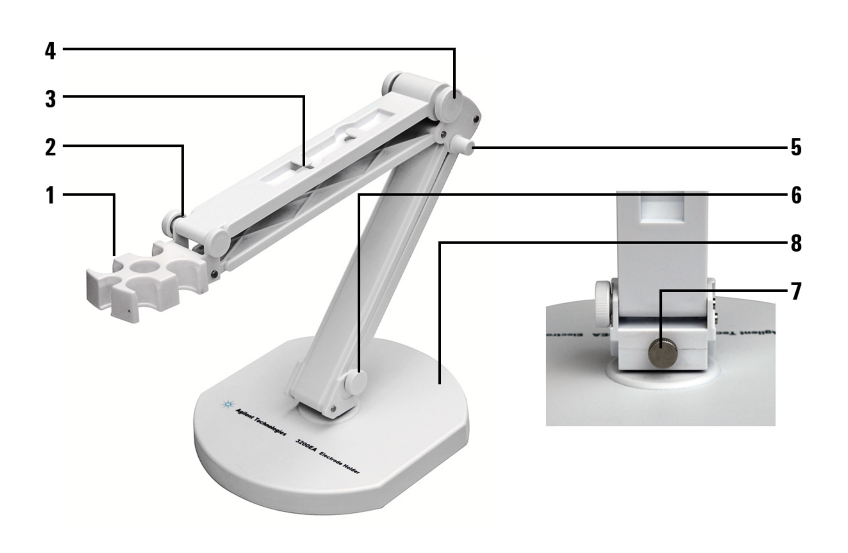
Agilent 提供安装所需的所有专业工具，在离子计 （套装）装运包装箱中可找到以下部件：

- 电极支架 (G4389A)
- 电极，如 P3211 pH Combination Electrode (5190-3988)
- 电源适配器 (5185-8389)

3200I 型离子计安装

打开 3200I 型离子计包装，取出离子计、电极支架以及相关附件。

电极支架的安装



1. 电极插孔	5. 紧固螺母
2. 紧固螺母	6. 紧固螺母
3. 电极线固定孔	7. 紧固螺母
4. 紧固螺母	8. 底座

电极的安装

在离子计的背面找到 pH/pX 电极接口、温度电极接口，然后，分别将离子选择型电极（或者pH复合电极）、温度电极（5190-3998）插入相应 pH/pX 电极接口和温度电极接口内，并将电极线夹在电极支架边缘固定孔中。



电源适配器的安装

仪器随机提供电源适配器。请注意，本适配器只适用于本仪器，不建议使用于其他类型的仪器。我们也不建议使用其他类型的电源适配器。

本电源适配器适用于以下电源：100 ～ 240VAC， 1A， 50/60Hz。

对应不同地区的电源，电源适配器提供多种转接插头，用户请正确选择合适的电源插头，然后按照图示将电源插头安装到适配器底座上，听到 “ 啪 ” 的一声表示已经安装到位。



接地线的安装

仪器随机提供接地线，但是接地线在测量过程中不是必须安装的。有时电极和被测溶液组成的测量部分会受到某些设备的干扰 （如恒温槽等设备） ，从而引起跳字、影响测量，此时必须将测量部分屏蔽起来，并安装接地线，消除干扰。当仪器受到干扰时，将 DC501 接地线一端连接仪器，另一端连接测量部分的屏蔽层，比如恒温槽的外壳等。

安装电化学数据采集软件和数据打印软件

本软件是为了方便用户使用而开发的一套数据采集软件（ 本软件 G4390A, 需要另外购买)。如果用户需要，请选择安装。

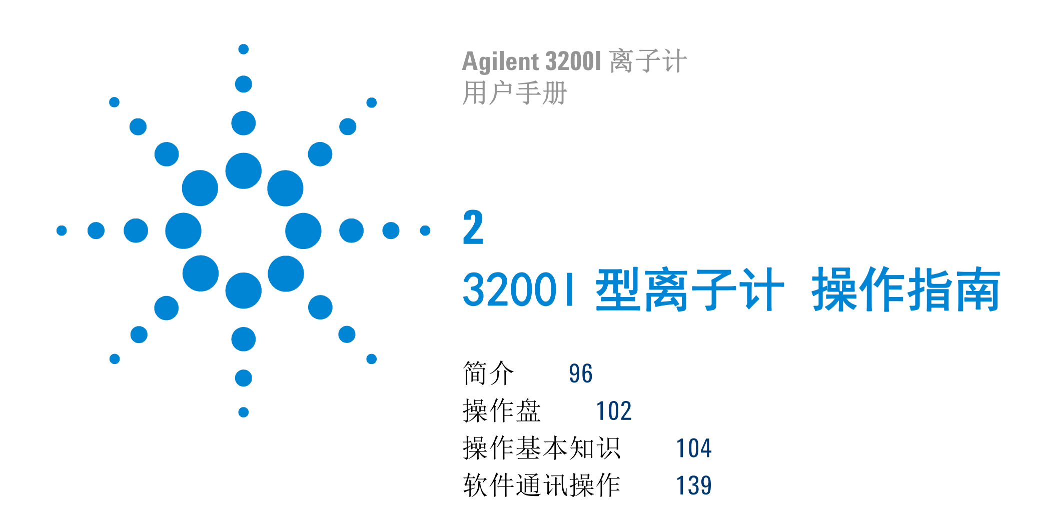
离子计安装好后，在计算机上安装电化学数据采集软件，采用 USB 接口连接线可实现与计算机通讯。请参阅电化学数据采集系统软件的安装说明。

如果用户需要将仪器测量数据、存贮数据以及标定参数打印出来，可以选择安装数据打印软件，软件支持接收仪器发送的数据并可将数据打印出来，本软件免费提供给用户。具体请参阅数据打印软件的安装说明。

获得更多信息

离子计和电化学数据采集软件的安装现在已经完成。有关更多信息，请参阅：

- 3200I 型离子计操作指南，以获得和熟悉日常操作说明。
- 电极操作指南，以获得电极使用和维护说明。



2
3200I 型离子计 操作指南

此文档提供对组成 3200I 型离子计的各个组件的概述。

简介

在哪里可以获得相关信息

除此文档之外， Agilent 还提供了其他相关说明产品，这些产品描述如何安装、操作和维护 3200I 型离子计及其故障排除。

使用离子计之前，请确保已阅读 3200I 型离子计安装指南和操作指南。使用离子计时最常见的安全问题有：

- 如果选用非原机配备电源适配器可能会发生不必要的安全问题。
- 必须有良好的接地。
- 防止腐蚀性气体侵入。
- 仪器的接口必须保持清洁、干燥，切忌与酸、碱、盐溶液接触。
- 仪器可供长期稳定使用。测试完样品后，所用电极应浸放在蒸馏水中。
- 离子计属于高精度的测量仪器，为了避免仪器的高阻器件受到损坏，当仪器不连接测量电极时，应将随机提供的短路插头 (G4383-40000) 插入测量电极接口上。当仪器连接电极时，必须将短路插头放置在干燥、干净的环境，防止短路插头受潮，再次使用时影响仪器性能，甚至损坏仪器。

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术语解释

pH 斜率：每变化 1pH 值产生电位的变化量，通常用 mV/pH 或 % 表示。

E_0：又称 " 零电位 "，通常是指 pH 为 7 时的电位值。

pH 的一点标定：用一种 pH 缓冲溶液进行校准。

pH 的多点标定：用两种或以上 pH 缓冲溶液进行校准。

3200I 型离子计的特点

3200I 型离子计是一台新颖、实用的实验室分析仪器，适用于实验室精确测量水溶液的 pH/pX 值、离子浓度、电位值与温度值。

其主要特点为：

- 支持测量 pH/pX 值、离子浓度、电位值、温度值。
- 支持 pH 标准缓冲溶液的自动识别，支持 NIST、 DIN、 GB 等标准。
- 支持多点标定功能，最多可以标定 5 点。
- 仪器允许测量多种常规的离子，仪器随机提供了多种常用的离子模式如：H^+、Ag^+、Na^+、K^+、NH_4^+、Cl^-、F^-、NO_3^-、BF_4^-、CN^-、 Cu^{2+}、 Pb^{2+}、 Ca^{2+} 等，方便用户使用。用户只要配以相应的离子选择电极和参比电极后即可直接测量相应离子的浓度，测量结束后进行各种浓度单位的转换。除了仪器提供的离子模式外，如果用户需要测量其他离子，只要用户有相应的离子选择电极，用户可以自定义离子模式，同样可以测量其他离子。
- 仪器具有多种离子浓度测量模式，支持直读浓度模式、标准添加模式、试样添加模式、 GRAN 模式。
- 支持三种测量模式：连续测量模式、定时测量模式和平衡测量模式，可以满足用户的不同测量需要。
- 采用点阵式液晶，显示清晰，外形美观。具有良好的人机界面，操作方便。
- 支持 GLP 规范：
  - 仪器要求设置操作者编号并记录。
  - 记录并允许查阅、打印标定数据。

- 支持贮存符合 GLP 规范的测量数据，包括 200 套 pH 数据、六种离子的各 100 套 pX 测量数据和各 100 套浓度数据。
- 允许查阅、打印、删除贮存的测量数据。
- 具有 USB 接口，配合专用的通信软件，可以实现与 PC 的连接。
- 具有断电保护功能，在仪器使用完毕关机后或非正常断电情况下，仪器内部贮存的测量数据、标定数据以及设置的参数不会丢失。
- 仪器支持自动关机功能。
- 仪器支持恢复默认数据功能；支持自诊断，可以诊断仪器是否正常工作。
- 带有背光设计，可以在阴暗的环境下使用。
- 采用新型材料 PC 面板，轻触按键设计，可靠性好，寿命长。
- 仪器具有固件升级功能，当仪器有功能性的拓展，仪器可以使用本功能更新。

3200I 型离子计的主要技术性能

3200I 型离子计的主要技术性能包括测量范围、分辨率、电子单元基本误差、仪器正常工作条件以及外形尺寸和重量。

1 测量范围

- pH：-2.000pH ～ 20.000pH；
  pX：0.000pX ～ 14.000pX；
- mV：-1999.9mV ～ 1999.9mV；
- 可选单位：mol/L、 mmol/L、 g/L、 mg/L、 ug/L
- 温度：-5.0 ～ 110.0 ℃。

2 分辨率

- pH/pX：0.1/0.01/0.001pH/pX；
- mV：0.1mV；
- 浓度：四位有效数字 （科学计数法表示）
- 温度：0.1 ℃。

3 电子单元基本误差

- pH/pX：±0.002pH/pX；
- mV：±0.03%FS；

- 浓度 : ±0.3% ;
- 温度 : ±0.1 ℃。

4 仪器正常工作条件

- 环境温度 : 0 ～ 40 ℃;
- 相对湿度 : 不大于 85%;
- 供电电源：电源适配器 （5185-8389，输入：100-240VAC，1A ；输出：9VDC， 1A) ;
- 周围无影响性能的振动存在;
- 周围空气中无腐蚀性的气体存在;
- 周围除地磁场外无其他影响性能的电磁场干扰。

5 外形尺寸 (长 × 宽 × 高， mm)：190×190×105。

6 重量 (kg)：约 1kg。

使用离子计的方法

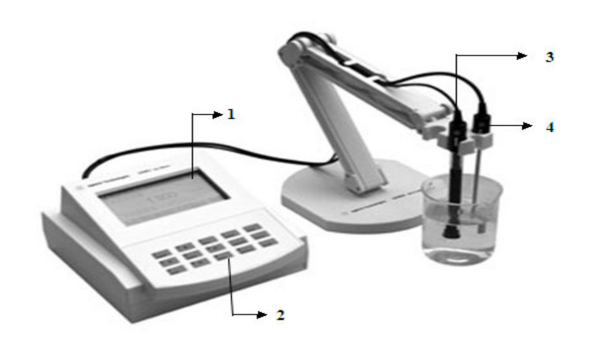
离子计是适用于精密测量各种液体介质的仪器设备，主要用来精密测量液体介质的 pH、 pX、离子浓度等。

使用离子计测量溶液 pH、pX、离子浓度等需要进行 5 个主要步骤。它们是：

1 功能设置
2 测量模式和测量参数的设置
3 电极准备
4 电极的标定
5 样品浓度的测定

操作过程中会显示 3200I 型离子计的状态，而且可以通过操作键盘相对应的按键更改用户的参数设置。离子计由电子单元和电极系统组成，电极系统由 pH 复合电极或者各种离子选择电极、温度电极构成 （一切以实际的装箱单为准）。

下面将描述此过程的每个部分。



1 显示屏

2 按键

3 pH 复合电极

4 温度电极

3200I 型离子计的前视图



1 显示屏

2 按键

3200I 型离子计的后视图



1 接地

2 参比电极接口

3 pH 电极 / 离子电极接口

4 温度电极接口

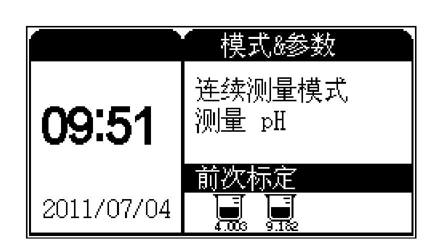
5 USB 接口

6 电源接口

操作盘

操作盘由显示屏和操作键盘组成。

显示屏



显示屏显示 3200I 型离子计目前正在执行的活动和工作状态。仪器正确连接电源后，按 “On/Off” 键打开仪器，仪器将显示公司名称、仪器型号、版本号等信息，并开始系统自检，完成后进入仪器的起始状态，仪器的起始状态显示如图，其中显示屏左面显示有当前的系统时间；右面为当前设置好的测量模式、测量参数以及上次标定情况。

操作键盘

3200I 型离子计有 15 个操作按键，分别为：1/ 输出键、 2/ ▲键、3/ 贮存键、4/◄ 键、5/ 设置键、6/► 键、7/ 查阅键、8/ ▼键、9/ 模式键、 0/ 测量键、·/ 标定键、-/ 删除键、确认键、取消键、开 / 关键等。除确认键、取消键外，其余都为双功能键，分别介绍如下：

1/ 输出键：输入数字 “1” ； 在查阅贮存数据或标定数据时输出贮存数据或标定数据；

2/ ▲键、4/◄ 键、8/ ▼键、6/► 键：输入数字 “2”、“4”、“8”、“6” ； 方向键，用于选择菜单等；

3/ 贮存键：输入数字 “3” ； 测量时贮存测量结果；

5/ 设置键：输入数字 “5” ； 不同操作情况下设置不同的功能；

7/ 查阅键：输入数字 “7” ； 查阅贮存数据或标定数据；

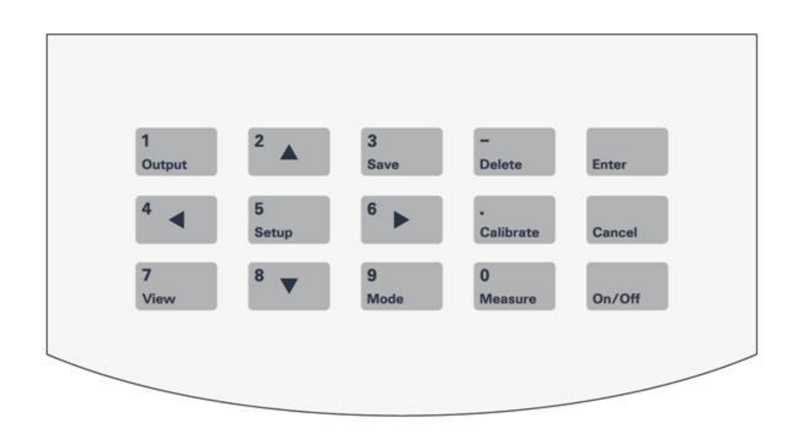
9/ 模式键：输入数字 “9” ； 测量状态下用于切换显示窗口或参数；

0/ 测量键：输入数字 “0” ； 在起始状态下开始测量；

·/ 标定键：输入小数；标定电极；

-/ 删除键：输入负数，清除全部输入；在查阅贮存数据时可以删除贮存的数据。

开 / 关键：打开或者关闭仪器。



操作基本知识

本节描述使用 3200I 型离子计可以执行的任务。

概述

操作离子计涉及下列任务：

- 启动 3200I 型离子计。启动 3200I 型离子计。
- 功能设置。请参阅 " 起始状态下的功能设置 "。
- 零点电位的校正。请参阅 " 零点电位的校正 "。
- pH 标液组的选择。请参阅 " 设置标液组 "。
- 电极准备。请参阅 " 电极准备 "。
- pH 电极的标定。请参阅 " 电极的标定 "。
- pH 值的测量。请参阅 "pH 值的测量方法 "。
- 电位的测量。请参阅 " 电位的测量方法 "。
- 温度的测量。请参阅 " 温度的测量方法 " 。
- pX 电极的标定。请参阅 "pX 电极的标定 "。
- pX 值的测量。请参阅 "pX 值的测量方法 "。
- 离子浓度测量。请参阅 " 离子浓度测量 "。
- 输出功能。请参阅 " 数据输出功能 "。
- 数据贮存。请参阅 " 数据的贮存 "。
- 数据删除。请参阅 " 数据的删除 "。
- 数据输出功能。请参阅 " 数据输出功能 "。
- 查阅功能。请参阅 " 查阅功能 "。
- 关闭 3200I 型离子计。请参阅 " 关闭 3200I 型离子计 "。

仪器控制

3200I 型离子计通常直接由操作按键控制。此外， 3200I 型离子计可以通过电化学数据采集软件与计算机通讯。

仪器还可以通过数据打印软件将测量数据、标定数据、存贮数据等打印出来。

启动 3200I 型离子计

首先要正确地安装和维护离子计。开机前，须检查电源是否接妥，应保证仪器良好接地。电极的连接须可靠，防止腐蚀性气体侵袭。仪器插入电源后，按 “On/Off” 键开机。

起始状态下的功能设置

仪器的起始状态显示如图 1，其中显示屏左面显示有当前的系统时间；右面为当前设置好的测量模式、测量参数为 pH 值以及前一次的标定数据。

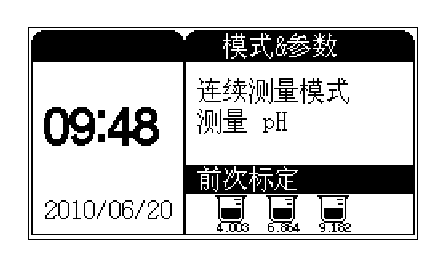


图 1

在起始状态下，按“设置”键可以设置“设置测量模式”、“系统设置”、“设置语言”、“设置手动温度”、“设置平衡条件”、“设置离子模式”、“设置自动关机”、“恢复默认设置”等。按“设置”键，仪器显示设置菜单，显示如图 2。

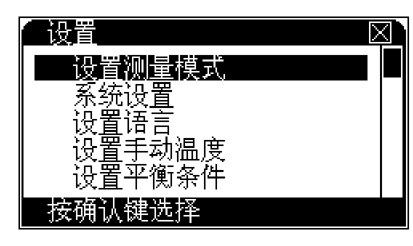


图 2

仪器突出显示当前的菜单项，用户可以按方向键选择合适的菜单项，按“确认”键选择相应的功能模块；按“取消”键退出功能菜单选择。

“设置测量模式”：设置当前的测量模式，连续测量模式、定时测量模式、平衡测量模式，对应离子浓度测量，则有直读离子浓度模式、标准添加模式、试样添加模式、GRAN 添加模式以及测量参数 pH、 pX、离子浓度等；

“设置手动温度”：如果仪器不接温度电极，可以使用手动温度值；

“设置平衡条件”：设置平衡测量模式下的各测量参数的平衡条件；

“系统设置”：设置系统时间、 GLP 选项；

“设置语言”：本仪器支持中、英文版本；

“设置自动关机”：仪器具有自动关机功能，用户可以设置自动关机时间；

“恢复默认设置”允许恢复测量参数至默认值，方便仪器自诊断；

“设置离子模式”：仪器支持多种常规离子模式，用户按照实际需要选择相应的离子模式即可。仪器也支持自定义离子模式。

设置测量模式

仪器支持三种测量模式，包括连续测量模式、定时测量模式、平衡测量模式。

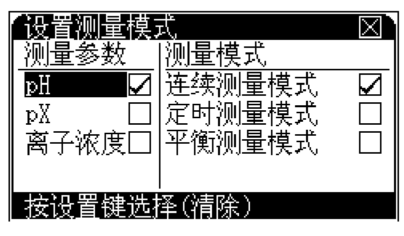


图 3

用户选择了相应的参数以及测量模式后，下次测量时即可按照当前设置情况进行测量。

在实际测量中，虽然用户选择了某个测量参数，仪器仍然允许用户随时查看其他参数值。

按“设置”键，再按“确认”键后，即可设置测量模式，显示如图 3，

其中左面为测量参数列表，即测量 pH 值、 pX 值或者离子浓度值；右面为测量模式列表，包括连续测量模式、定时测量模式、平衡测量模式；显示“ √ ”的表示为当前选中的测量参数或者测量模式；突出显示的表示当前光标位置；按方向键移动光标位置；移动到合适的项目后，按“设置”键选择（或清除）当前项目。按“确认”键，仪器自动保存当前的所有设置，返回起始状态；按“取消”键，仪器放弃当前设置返回起始状态。图 4 即为选择测量参数后实际测量显示图。

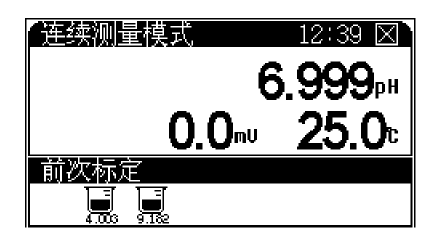


图 4

为了方便用户随时查看其它参数值，仪器设置了一个特别的查看功能。在测量状态下，按“模式”键，仪器即突出显示测量窗口，如图 5，重复按“4/◄”或“6/►”键，可以查看其他测量参数，比如，当前测量参数为 pH 值，则重复按“4/◄”或“6/►”键时，仪器会在 pH 值、电位值之间来回切换。查看结束，如果用户在几秒钟里面没有继续按键，仪器会自动退出查看状态。这个功能有利于多个参数的切换。

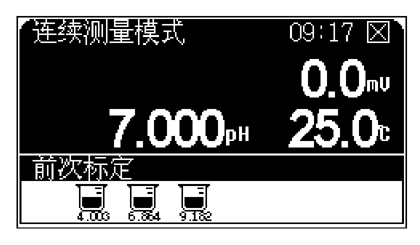


图 5

当用户选择测量参数为离子浓度时，相应的测量模式更换为离子浓度测量模式，包括直读浓度模式、标准添加模式、试样添加模式、GRAN 模式等。

连续测量模式　这是最常使用的一种测量模式，开始测量后，仪器始终连续测量、计算和显示测量结果，用户在测量期间可以查阅测量参数、标定电极、贮存或打印测量结果等等。测量结束，用户按“取消”键并“确认”后退出测量模式。

定时测量模式　定时测量模式是为了方便用户检测需要而设置的，比如需要连续 30 分钟测 pH 值，则用户可以选择这种定时测量模式，开始测量后，仪器会自动测量、计算和显示测量结果，到用户设定的时间间隔时，仪器自动贮存测量数据，然后开始下一次测量。按“取消”键并“确认”后可以退出定时测量模式。

如果用户选择定时测量模式，需要设置定时间隔，时间间隔 1~99 分钟，默认间隔为 10 分钟。

平衡测量模式　用户首先应该设置好平衡条件（详见“设置平衡条件”），开始测量后，仪器自动测量、计算并显示测量结果，一旦测量符合设定好的平衡条件，本次测量即结束。

在测量过程中，用户可以查阅测量参数、标定电极等。测量结束后，用户可以贮存、打印测量结果；按“取消”键退出测量状态，或者选择按“测量”键开始下一次测量。

直读浓度测量模式　一种最常规的离子浓度测量方法。开始测量后，仪器始终重复计算、显示电位值，等显示的电位稳定时，按“确认”键，仪器自动计算出当前的浓度值。

标准添加测量模式　用户将标准溶液添加到试样中，测量添加前后电位的变化量，从而测定样品浓度的测量方法。

试样添加测量模式　与标准添加测量模式类型，用户将样品溶液添加到标准溶液中，测量标准溶液添加前后电位的变化量，从而确定样品浓度的测量方法。

GRAN 测量模式　GRAN 即多次标准添加法。用户重复多次将一定量的标准溶液添加到试样中，测量每次添加后电位的变化量，从而测定样品浓度。

设置手动温度

温度电极插口如果连接有温度电极，仪器自动采用温度电极的温度值，反之，仪器采用用户设定的手动温度值。按 " 设置 " 键，选择 "设置手动温度"项，按"确认"键，仪器即进入手动温度设置模块。如图 6，按 " 设置 " 键修改手动温度值。用户按照实际需要，输入手动温度值即可。

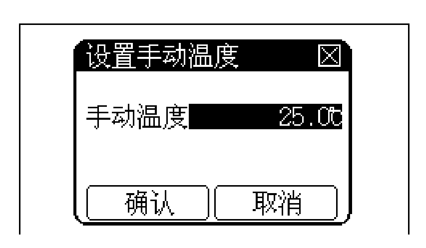


图 6

设置平衡条件

平衡测量条件对应平衡测量模式，设置各测量参数的平衡条件，图 7 显示 pH 值的平衡条件为 0.010pH，平衡时间为 5s，则表示在 5s 时间内，pH 值的变化量小于 0.010pH 时即认为本次测量有效。



图 7

当用户选择平衡测量模式进行测量时，如果在设定的平衡时间里所有测量都符合平衡条件，则本次测量结束。平衡时间只对平衡测量模式有效，以秒 (s) 为单位，范围 1 ～ 200 秒。

系统设置

系统设置包括 GLP 规范设置、电极标定提示间隔、系统时间等。按“设置”键，选择“系统设置”项，按“确认”键，仪器即进入系统设置模块，如图 8 所示。

按方向键移到至相应项后按“设置”键即可修改相应的参数值。修改完毕，按“取消”键退出设置状态，返回起始状态。

“**电极标定提示间隔**”是指仪器提示用户标定电极的时间间隔，仪器会自动计算前一次标定至今的时间，如果已经超过用户设定的标定时间间隔，即弹出提示窗口，提示用户注意重新标定电极，电极标定间隔以小时 (h) 为单位（设置为 0 小时，则将关闭提示）。

操作者编号是一个三位数的编号，编号范围为 000 ～ 200。



图 8

小心

自动删除贮存数据功能是指当贮存数据量达到仪器最大贮存量时是否允许自动覆盖，重复贮存。比如，仪器允许贮存测量数据 200 套，当贮存第 201 套数据时，如果自动删除贮存数据功能打开，则仪器自动将第 201 套数据存入第一个数据的位置，即从头开始贮存，如果自动删除贮存数据功能没有打开，则仪器会提示 用户：从头开始贮存还是放弃当前的测量数据。

“**设置系统时间**”，移动至时间项，按“设置”键即可设置时间。显示如图 9，窗口显示当前时间，包括“年”、“月”、“日”、“时”、“分”、“秒”。

如果用户需要修改时间，按方向键移动光标至需要修改的时间项，按“设置”键，并输入相应时间值。

例如用户需要设置当前的月份时，可按如下方法操作：按方向键移动光标至“月”项，按“设置”键，仪器弹出输入窗口，用户按照当前月份输入，输入完毕按“确认”键退出输入窗口。同理，可修改其他时间项，等所有的时间项修改完毕，按“确认”键即完成最后的设置，按“取消”键退出系统时间设置模块。

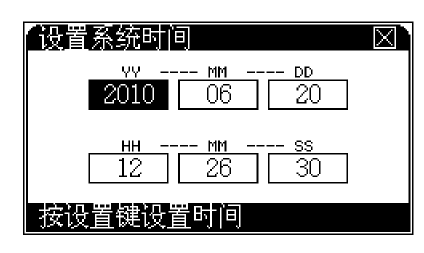


图 9

语言设置

本仪器提供中英文版本供用户选择。在起始状态下，按“设置”键选择“语言设置”后确认，用户即可选择中文或者英文版本。

设置自动关机

本仪器支持自动关机功能，允许用户设置关机时间。自动关机时间为 10~480min，当仪器运行至设定的自动关机时间时，仪器将强制关机。设置零值，可以关闭自动关机功能。当仪器连接电化学数据采集软件时，此功能无效。

恢复默认设置

由于某些操作或者使用上的原因，可能会导致测量参数的改变，利用此功能可以恢复至默认值。执行此功能后的具体参数如下：

- 清除零点电位：
  此功能可防止由于用户误操作等原因影响准确测量。此时连接短路插头后，仪器电位值可能不显示零值，需要重新校正零点电位。
- 修改标液组设置：
  将 NIST 标液组的标液设置为 3 点：4.01pH、 7.00pH、 10.01pH ； DIN 标液组的标液设置为 5 点：1.68pH、 4.01pH、 6.86pH、 9.18pH、 12.45pH ； GB 标液组的标液设置为 5 点：1.68pH、 4.01pH、 6.86pH、 9.18pH、 12.45pH ；选择 GB 作为当前的标液组。
- 修改 pH 的标定数据：
  标液数为 3 个； 具体标液数据如下，此时默认电极斜率为 100%，零点为 0.0mV。
  - 标液 1: 4.003pH/177.299mV/25.0 ℃ ,
  - 标液 2: 6.864pH/ 8.046mV/ 25.0 ℃ ,
  - 标液 3: 9.182pH/-129.085mV/ 25.0 ℃。
- 修改系统其他离子模式的标定数据至默认值。
- 设置离子浓度测量时标定状态下的浓度单位为 mol/L ；
- 设置离子浓度测量时的结果浓度单位为 mol/L ；
- 设置当前的离子模式为 Na^+ ；
- 设置手动温度为 25.0 ℃；
- 设置测量模式为连续测量模式；
- 设置定时测量模式的定时间隔为 10min ；
- 关闭标定间隔提示功能；
- 允许数据从头覆盖；
- 设置操作者编号为 000 ；
- 设置平衡测量模式下的平衡条件为 0.1pH ；
- 设置平衡测量模式下的平衡时间为 5s ；
- 设置 pH 显示分辨率为 0.001pH ；
- 设置自动关机时间为 0，即关闭自动关机功能。

设置离子模式

离子模式主要是为了方便用户使用而设计的。仪器提供了常规的大约 10 多种离子模式对应不同的离子测量，用户可选用相应的离子模式直接进行浓度测量。浓度测量结束后，用户可以按照不同的离子浓度单位查看当前离子浓度值。

按 " 设置 " 键，选择 " 设置离子模式 " 后，按 " 确认 " 键即可进入 " 设置离子模式 " 功能模块，显示如图 10。

设置离子模式

离子1	离子2	自定义
Ag^+	Cu^{2+}	
Na^+	Pb^{2+}	
K^+	Ca^{2+}	
NH_4^+		

离子 Na^+,分子量：23.0

图 10

仪器分别将离子分成了两部分，常规离子和用户自定义离子。仪器提供了一些常规的离子模式，分别为: H^+ 、Ag^+、Na^+、K^+、NH_4^+、Cl^-、F^-、NO_3^-、BF_4^-、CN^- 以及 Cu_2^+、Pb_2^+、Ca_2^+ 等离子（由于 H^+ 始终允许，因此在设置离子模式里没有显示）。下方显示有当前选中离子的名称和分子量），按方向键移动光标位置选中相应的离子（反向突出显示），按 " 确认 " 键，仪器将当前选择的离子模式作为实际测量的离子模式；按 " 取消 " 键退出离子模式设置功能模块，返回起始状态。

允许用户自定义离子模式，只要用户有相应的离子选择电极，同样可以按照常规的离子模式操作方法进行离子浓度的测量。

如果还没有自定义离子，直接按 " 设置 " 键，可以建立新的自定义离子。

自定义离子名称由系统自动分配，支持最多 5 种自定义离子模式，即 Cus00~Cus04。

用户可按照实际情况，分别设置离子的阶数、分子量，设置完毕按 " 确认 " 即可。

将光标移动到自定义离子部分，按“设置”键，并选择“新建离子模式”、“修改离子模式”或者“删除离子模式”等即可由用户自己管理自定义离子模式。

用户必须选择正确的离子模式后才能开始浓度测量，如果选用了不同的离子模式，那么将导致最后结果不正确。比如用户需要测量钠离子浓度，则首先应该由“设置离子模式”功能模块中选择“Na^+离子模式”，然后才可以开始钠离子的浓度测量，其他依此类推。

小心

当用户删除某个自定义离子模式时，与之相应的所有存贮数据都将同时删除。

电极准备

1 请确认电极使用前的保存状态符合“电极保存”中要求。如果没有妥善保存，将电极在保存溶液中浸泡至少 2 小时。
2 将测试探头从保护套或储存瓶中拿出来，保存保护套或储存瓶以备后用。
3 如果有电解质固体在测试探头的外面，用蒸馏水清洗干净。
4 电极测量端向下，空用电极数次，以去除电极中的气泡。
5 对可充式电极，打开加液塞，加相应的填充溶液。为了保证填充液流动，在使用时加液塞须打开，填充液面必须高于样品液面和液接界至少 2cm。

pH 值测量前的准备

开始测量前，用户需要进行以下一些操作步骤，才能更好地使用仪器，完成准确测量。这些步骤包括：仪器零点电位校正；设置合适的标液组 , 并选用合适的标准缓冲溶液来标定电极；开始测量。

校正零点电位

尽管仪器在设计中考虑到了诸多影响测量的因素，比如环境温度对仪器的影响，但是仍然无法保证仪器能达到零漂移的理想状态。为了保证仪器的高精度测量，用户应在测量前进行电位零点校正。

仪器连接短路插头（G4383-40000），开机 30s 后，在测量或者标定状态下，电位显示值偏离零点电位 0.0mV 较大时需要校正零点电位。按“设置”键，选择“校正零点电位”后，按“确认”键，仪器提示“校正当前零点电位吗？”字样，要求用户确认。按“确认”键即可校正电位零点，反之按“取消”键将放弃操作，返回测量状态。

小心 校正零点电位时必须连接短路插头。如果仪器测量值明显偏移目标数据，首先应该连接短路插头，检查仪器零点是否正常，避免因操作不当造成零点校正错误。

设置标液组

为了方便用户使用，仪器支持自动识别功能，能够识别多种标液组，包括 NIST 标准、 DIN 标准、 GB 标准。每种标液组支持多种标准缓冲溶液，共计 24 种标准缓冲溶液。其中 NIST 标液组包含标液1.680pH、4.008pH、6.864pH、7.00pH、7.416pH、10.014pH、12.469pH等标液； DIN标液组包含1.680pH、3.557pH、3.775pH、4.008pH、 6.865pH、 7.000pH、 7.416pH、 9.184pH、 10.014pH、12.454pH 等标液； GB 标液组包含 1.680pH、3.559pH、4.003pH、6.864pH、 7.409pH、 9.182pH、 12.460pH 等标液。每个标液组最多允许选择 5 种标液。由于每个标液组里面多种标准缓冲溶液之间的 pH 范围相互可能有重叠，为了保证测量精度，仪器将限制相邻标液的选择。

在查阅 pH 测量参数下，按“设置”键进入设置当前标液组模块，显示如图，图中表示当前的标液组为 DIN 标准。系统共提供 3 种标液组，分别为 NIST、 DIN、 GB 标准。图 11 中，上方显示有 3 种标液组，下方对应标液组的具体标液。用户可按方向键移动光标条来查看标液，按“确认”键选择标液组并退出设置标液组模块，返回查阅标定数据模块。

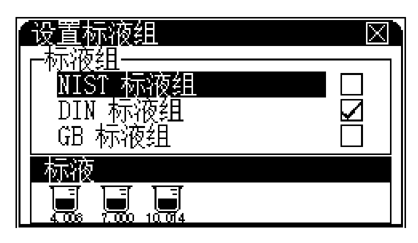


图 11

如果用户需要修改某个标液组里面的具体标液，移动光标至相应标液组，按“设置”键即可设置，显示如图 12，图示为 NIST 标液组选择标液的示意图，其中每个图标对应每种标准缓冲溶液，打勾的图标表示此标液已被选择、没有打勾的图标表示未被选择；突出显示的图标表示当前的标液是可操作的，此时按一次“设置”键即可选择或清除当前标液，图标下显示当前标液的标称 pH 值；窗口下面同时会显示相应标液的范围。用户按方向键移动光标至需要的标液，然后按“设置”键选择或者清除选择。

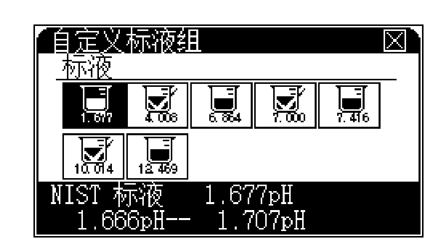


图 12

比如用户需要选择 4.008pH 标液，则移动光标至对应 4.008pH 标液的图标位置，按“设置”键，显示 4.008pH 的图标立即打勾显示，表示已被选择。

为避免标液间 pH 值重叠而影响标定，用户应选择实际使用的对应标液，对于其他用户不用的标液，应全部清除选择。

对应每个标液组，仪器最多允许选择 5 种标液。

pH 电极的标定

1 在每次测量以前，建议用户对电极进行重新标定，一旦标定后，前一次的标定数据将会被覆盖。
2 电极使用一段时间后，也应该重新标定。
3 设置电极标定时间间隔至合适的值后，仪器可以自动提示。

4 pH电极标定前确认pH标液组pH标定显示如图 13，其中屏幕上半区为当前的测量数据，仪器显示当前的 pH 值 (斜率设定为 100.00%)、电位值和温度值；屏幕下面为当前的标定结果。

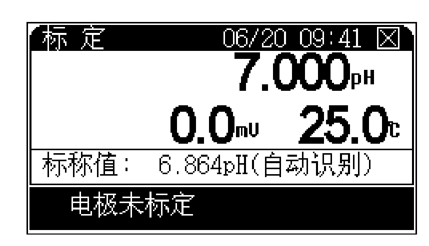


图 13

自动识别（或手动识别）表示当前仪器的识别方式，按 “ 设置 ” 键可选择识别方式，或者设置当前标液组；当电极放入标液显示稳定后，按确认键即可标定当前标液；按 “ 取消 ” 键退出标定，如图 14 所示。

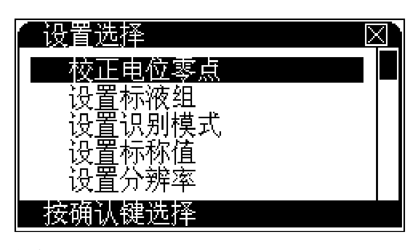


图 14

仪器具有自动识别标准缓冲溶液的功能，本仪器可以自动识别多种标准缓冲溶液。由于多种标准缓冲溶液之间的 pH 范围相互有重叠，为了保证测量精度，在开始标定前，用户应检查一下设置好的标液组。比如，如果用户用 4.003pH、9.182pH 两种标准缓冲溶液标定电极斜率，那么当前标液组中必须设置为 4.003pH 和 9.182pH 两种标准缓冲溶液， 否则仪器不会自动识别此两种标准缓冲溶液，

从而影响标定结果甚至出现标定错误信息。在标定状态下，按“设置”键选择设置标液组即可设置当前的标液组（具体设置参见**设置标液组**部分），标定步骤如下：

1 开始标定前，用户准备 1 至 5 个标准缓冲溶液（可以是常规的标准缓冲溶液，也可以是用户自己的标准缓冲溶液），置于恒温下放置一定时间；
2 按照前面介绍的**设置标液组**，如果是非常规的标准缓冲溶液，请选择手动识别方式；
3 将 pH 电极、参比电极、温度电极等清洗干净后一起放入待标定的标准缓冲溶液中；
4 等显示稳定后，按“确认”键，仪器显示“存贮数据……”并存贮标定数据；
5 稍后，仪器提示用户“继续标定吗？”，如果用户有其他的标准缓冲溶液需要标定，则可选择继续标定，然后重复前面的步骤标定其他标准溶液，直至标定结束！在标定过程中，用户随时可按“取消”键结束标定。
6 本仪器支持最多 5 点标定，当标定至第 5 个标液并确认后，仪器会自动提示用户结束标定。

对于pH范围相互有重叠的标准缓冲溶液，比如6.864pH和7.000pH两种标准缓冲溶液，建议采用如下方法标定：

第一种　当用户标定 6.864pH 标准缓冲溶液时，请将标液组设置为只有 6.864pH 标准缓冲溶液，然后标定，等 6.864pH 标液标定完后，重新设置标液组，将标液组设置为只有 7.000pH，然后标定即可。

第二种　采用手动识别方式标定，即每次标定标准缓冲溶液时，手动输入当前标液对应当前温度下的标称 pH 值，也可完成标定，但是此方法比较烦琐。

对常规的标准缓冲溶液，用户可使用自动识别功能，配合前面设置的标液组，仪器将自动识别这些标准缓冲溶液，用户不必改变识别方式即可标定（如果无法识别，仪器会提示用户：标定错误，要求用户或更换电极、或重新设置标液组、或将自动识别方式改为手动识别，用户可按实际情况选择操作）。

当用户使用自己的标准缓冲溶液（非常规标准缓冲溶液）来标定电极时，必须使用手动识别方式。

比如，用户有一个标准缓冲溶液，已知 25.0 ℃时的标称 pH 值为 2.704pH，25.1 ℃时的标称 pH 值为 2.710pH，25.2 ℃时的标称 pH 值为 2.720pH，则用户应尽量将标定时的温度恒定在 25 ℃。开始标定后，首先将识别方式设置为 " 手动识别 "，等显示稳定后，按 " 确认 " 键，仪器要求用户输入当前温度下的标称 pH 值，如果当前温度为 25.2 ℃，则输入 2.720，输入完毕按 " 确认 " 键，仪器贮存当前的标定数据，其它标液点的标定以此类推。

如果用户既有常规标准缓冲溶液，又有自己的标准缓冲溶液，则只需分别按自动识别方式和手动识别方式操作即可。

pH 值的测量方法

在起始状态下，测量参数为 pH 值，如果不是，则可以由 " 设置测量模式 " 功能来选择测量参数为 pH，详见设置测量模式章节。

测量开始后，先校正零点电位。校正完毕即可开始并测量。具体标定和校正零点电位请参阅 "pH 电极的标定 "、" 校正零点电位 " 等章节。

在仪器的起始状态下，按 " 设置 " 键选择需要的测量模式，完成后按 " 测量 " 键即可进入相应测量状态，显示如图 15。其中显示屏上方显示有当前的测量模式、系统时间；测量主窗口显示当前的 pH 值以及对应的电位值和温度值。

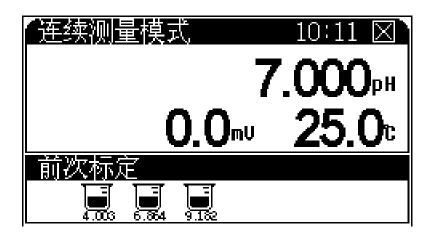


图 15

在测量过程中，用户可以重新标定电极、设置测量参数、设置 pH 的显示分辨率等；测量结束后，用户可以按 " 贮存 " 键，存贮测量数据；按 " 输出 " 键输出测量数据；按 " 取消 " 键结束测量。

小心 对应不同的测量模式，连续测量模式、定时测量模式和平衡测量模式其测量和控制过程会有很大不同，用户应根据自己需要选择合适的测量模式进行测量。

电位的测量方法

在任意测量状态下，仪器将始终显示当前的 pH 值和电位值。具体操作参见 pH 的测量章节。

温度的测量方法

在任意测量状态下，仪器连有温度电极时，仪器将直接显示当前溶液的温度值。具体操作参见 pH 值的测量章节。

pX 测量

本章节介绍有关测量 pX 值的电极准备、选择离子模式、电极标定、测量等信息。

pX 值测量前的准备

同 pH 测量类型，开始测量 pX 值前，用户需要进行以下一些操作步骤，才能更好地使用仪器，完成准确测量。这些步骤包括：选择离子测量模式；校正仪器零点电位；选用合适的标准溶液来标定电极；开始测量。

设置离子测量模式

用户必须选择正确的离子模式后才能开始浓度测量，如果选用了不同的离子模式，那么将导致最后的结果不正确。比如用户需要测量钠离子浓度，则首先应该由 " 设置离子模式 " 功能模块中选择 "Na^+ 离子模式 "，然后才可以开始钠离子的浓度测量，其他依此类推。

校正零点电位

同 pH 测量类型，为了保证高精度测量，用户应在测量前进行零点电位校正。详见 pH 测量章节。

pX 电极的标定

在每次测量以前，建议用户对离子选择电极进行重新标定；离子选择电极使用一段时间后，也应该重新标定。重新标定后，前一次的标定数据将会被覆盖。

在 pX 测量状态下，按 " 标定 " 键选择 "pX 电极 "，按 " 确认 " 键可以标定电极斜率。仪器进入标定模块，显示如图 16。

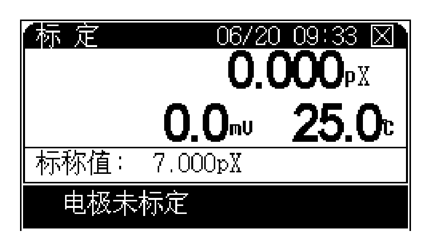


图 16

其中屏幕上半区为当前的测量数据，仪器显示当前的 pX 值 (斜率设定为 100.00%)、电位值和温度值，以及对应当前标液的标称浓度值 (pX 值) ；屏幕下面为当前的标定结果。

开始标定前，用户应准备好 1 至 5 个标准溶液，将它们置于恒温下放置一定时间，即可开始电极标定，标定步骤如下：

1 将相应的离子选择电极 （或者参比电极）、温度电极等清洗干净后一起放入待标定标准溶液中；

2 按 " 设置 " 键选择设置标称值项，然后输入当前标液在当前温度下相应的标称浓度值 (pX 值) ；

3 等显示稳定后，按 " 确认 " 键，仪器显示 " 存贮数据 ..." 并存贮标定数据；

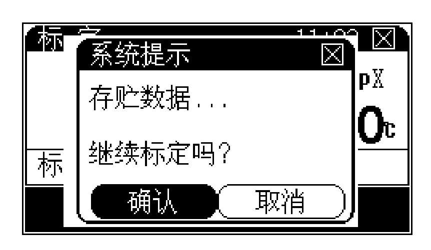


图 17

4 稍后，仪器提示用户“继续标定吗？”，显示如图 17，如果用户有其他的标准溶液需要标定，则可按“确认”键，然后重复前面的步骤标定其他标准溶液，直至标定结束！

5 在标定过程中，用户随时可按“取消”键结束标定。

pX 值的测量方法

在起始状态下，测量参数为 pX 值，如果不是，则可以由“设置测量模式”功能来选择测量参数为 pX，详见设置测量模式章节。

测量开始后，先校正**零点电位**。校正完毕即可开始并测量，显示如图 18。具体标定和校正零点电位请参阅“pX 电极的标定”、“校正零点电位”等章节。

在测量过程中，用户可以重新标定电极、设置测量参数等；测量结束后，用户可以按“贮存”键，存贮测量数据；按“输出”键输出测量数据；按“取消”键结束测量。



图 18

离子浓度测量

本章节介绍离子浓度的测量方法。本仪器支持直读浓度模式、标准添加模式、试样添加模式、 GRAN 模式等测量模式。

直读浓度模式

本模式按照能斯特公式，有以下计算式：

$$E_x = E_0 + S \times \log(C_x + C_b)$$

式中：

E_x ～待测试样 (样品) 的平衡电位；

E_0 ～零电位值；

S ～电极斜率；

C_x ～待测试样的浓度值；

C_b ～空白浓度值。

由此，用户只需经过相应的斜率校准，得到斜率以及零电位值，即可对待测试样进行浓度测量。如果用户需要测定空白标准液的浓度值 (即空白浓度值), 那么用户可选择进行空白浓度值的测定。

用户按照使用的离子选择电极选择好相应离子模式后 （**比如测量 Ag 离子浓度，则选择离子模式为 Ag 离子，具体参见设置离子模式章节**）；设置测量参数为离子浓度，并选择直读浓度模式（**参见设置测量模式章节**），选择完毕按 “ 确认 ” 键返回起始状态，按 “ 测量 ” 键进行直读浓度测量，显示如图 19。其中显示屏左上方为当前系统时间、当前的测量电位和温度值以及相应的 pX 值，下方显示为当前测量结果以及相应的空白浓度值。



图 19

如果需要用户可以校正空白浓度值。

在测量过程中可以查阅标定数据、电极标定、校正电位零点、校正空白浓度、空白浓度清零等。

用户将相应离子选择电极清洗干净后放入被测溶液中，仪器显示当前测量值，当读数稳定后，按“确认”键，仪器即计算出测量结果，显示如图 20。此时，按“贮存”键可以将当前测量结果存贮起来，按“测量”键则继续下一次离子浓度测量，按“取消”键即退出直读浓度测量模式，返回仪器起始状态。

如果用户需要选择样品浓度的浓度单位，按“设置”键并选择合适的浓度单位。

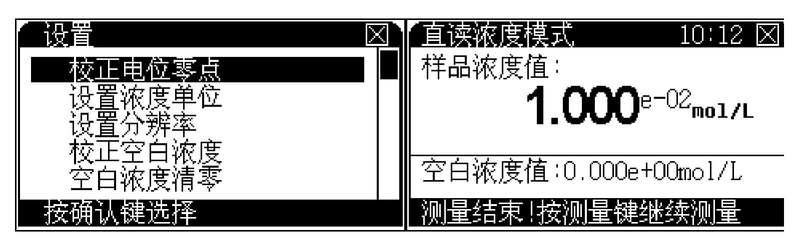


图 20

直读浓度模式空白浓度校正

如果用户需要进行空白浓度校正，则可以选择空白浓度校正。进入空白浓度校正后，显示同直读浓度测量模式，显示如图 21。



图 21

用户准备好空白标准溶液后，将相应的离子选择电极和温度电极一起放入溶液中，等显示稳定后，按“确认”键，仪器即计算出空白浓度值并自动存贮。按“取消”键，仪器返回直读浓度测量状态。

在校正过程中，用户随时可以按“取消”键退出校正，返回直读浓度测量状态。

小心

1、空白校正时，所用空白溶液化学组成应与待测溶液接近，除了待测离子浓度的不同。

2、在直读浓度模式和标准添加模式中有空白校准，具体操作同本测定模式。

空白浓度清零

如果用户希望清除上次的空白浓度值，则可以选择此功能。

标准添加模式

标准添加模式又称已知添加模式。首先，测定体系的平衡电位值，然后在待测体系中加入已知浓度的标准溶液，再次测定体系的平衡电位值，由添加前后的电极电位的变化值，从而计算出待测试样的浓度值。计算公式如下：

$$Cx = \frac{\rho \times Cs}{(1+\rho)\times 10^{(E2-E1)/S} - 1} + \frac{\rho \times Cb}{(1+\rho)\times 10^{(Eb2-Eb1)/S} - 1}$$

式中，

C x ～待测试样的浓度值；

C s ～标准液（添加液）的浓度值；

S ～电极斜率；

C b ～空白标准浓度值；

E 1 ～体系未添加标准液前时测得的电位值；

E 2 ～体系添加标准液后所测得的电位值；

ρ ～标准液添加体积 (Vs)/ 待测试样体积 (Vx)；

E b1 ～空白校准时体系未添加标准液前时测得的电位值；

E b2 ～空白校准时体系添加标准液后所测得的电位值。

测量前，先输入标准液的浓度值及添加体积，再输入试样的体积，然后测得添加前的电极电位值 E 1 和添加后的电极电位值 E 2，仪器即可按上述公式计算出试样的浓度值 C x。如果用户需要进行空白校准，则按照类似方法，分别测量空白标准液添加标准液前后的电极电位变化值，即测定 E b1、 E b2，然后可计算出空白标准液的空白浓度值。

在仪器的起始状态下，选择好相应离子模式后，按 " 测量 " 键即可进入标准添加测量模式，显示如图 22，包括添加体积、添加前的体积、标液浓度值、标液浓度单位以及空白值。其中添加体积指即将添加的标准液体积量，添加前体积即为试样的体积量，标液浓度指添加的标准液浓度值。

标准添加模式

添加体积：0.1mL
添加前体积：10.0mL
标液浓度：1.000e+02
标液浓度单位：mol/L
空白浓度：0.000e+00mol/L
按确认键开始测量

图 22

用户按方向键选择需要修改的参数项，按 " 设置 " 键修改参数或者校正空白浓度等。设置完成，按 " 确认 " 键即可开始测量。将离子选择电极清洗干净后，放入被测试样液中，仪器显示（图 23）当前的电位、温度值以及相应的 pX 值。

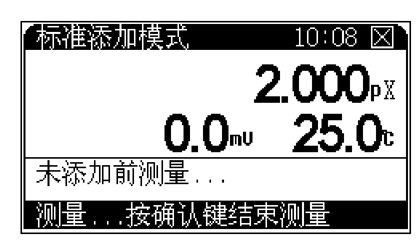


图 23

等显示稳定后，按“确认”键，仪器存贮当前的电位，并显示“添加标液”字样，用户按设定的体积值添加标液，等再次显示稳定后，按确认键，仪器提示“测量结束！”字样并计算当前试样的浓度值，显示如图 24 所示：

标准添加模式 10:10
2.000pX
0.0mV 25.0℃
添加后测量...
测量...按确认键结束测量

标准添加模式 10:11
样品浓度值：
1.000e+02mol/L
空白浓度值：0.000e+00mol/L
测量结束！按取消键结束校正

图 24

测量结束，用户可以贮存、打印测量结果。

试样添加模式

本模式类似于标准添加模式，只是在标准添加法中，是将标准液添加到试样中，测量由于待测组份的浓度变化而引起的电极电位变化，从而测定试样的浓度值，同样地，如果将试样添加到标准液中，通过测量添加前后的电位变化，也可测定试样的浓度值。计算公式如下：

$$Cx = Cs \times [(1+\rho)\times 10^{(E2-E1)/S} - \rho]$$

式中，

C x ～待测试样（添加液）的浓度值；

C s ～标准液的浓度值；

ρ ～标准液的体积（V s）/ 待测试样的体积（V x);

E 1 ～未添加待测试样时体系的电位值；

E 2 ～添加待测试样后体系的电位值；

S ～电极斜率。

在仪器的起始状态，选择好相应离子模式后，按“测量”键并确认后即可进入试样添加测量模式，开始测量前同样需要设置一些基本参数，显示如图 25。测量开始后其操作与标准添加测量模式类似。

试样添加模式	☒
添加体积：	0.1mL
添加前体积：	10.0mL
标液浓度：	1.000e+02
标液浓度单位：	pX
按确认键开始测量	

图 25

GRAN 测量模式

仪器除常规测量方法外，也可用 GRAN 测量模式来测量含量较低的试样。根据 GRAN 模式的数学原理，可用下式测得试样的浓度值。

$$(Vs+Vx)\times 10^{E/S}=10^{E0/S}\times(CxVx)+10^{E0/S}\times(CsVs)$$

测量时，先输入标准溶液的浓度 (C s) 和体积 (V s)，以及待测试样的体积 (V x)，然后测量每次添加标准液后待测试样中的电极电位值，依次重复测量三次至八次，仪器即可计算出待测试样的浓度值。其操作方法与前面的标准添加模式类型。

数据贮存功能

本仪器支持贮存 200 套 pH 值测量数据，每个离子模式允许存贮 pX 测量数据 和离子浓度数据各 100 套，同时仪器最多允许存贮 6 种离子模式的 测量数据，即 600 套 pX 测量数据和 600 套离子浓度测量数据。超过限量时将允许从头开始贮存。在不同的测量模式下，数据贮存方式有所不同，在连续测量模式和平衡测量模式，用户需等待测量结果稳定后按“贮存”键来手动贮存测量数据；在定时测量模式时，仪器按照设定的定时间隔，自动定时贮存测量结果，当然用户也可以手动贮存结果。具体的测量操作方法参见前面相关章节。

数据删除功能

仪器支持贮存测量数据，也支持删除测量数据功能。对于某些因操作不当或其他原因造成的不确定测量结果，用户可以逐个删除或者全部删除。仪器只有在查阅贮存数据状态下才能完成操作。具体操作方法如下：通常在仪器的起始状态下或者测量状态下，按 “ 查阅 ” 键选择查阅相应贮存数据，进入查阅贮存数据后，按 “ 删除 ” 键，选择相应操作即可。

数据输出功能

如果用户需要输出当前的测量数据、上次标定数据或者已贮存的数据，有两种方法可以实现。一种是用数据采集软件连接仪器，实现上述功能。

另一种是使用数据打印软件。用 USB 连接线连接仪器与 PC 机，然后在 PC 机上运行本软件，当用户在测量、查阅标定数据、查阅存贮数据时按 “ 输出 ” 键，本软件将自动接收仪器发送的相应数据，用户选择打印即可，详细参见软件操作指南。

数据查阅功能

3200I 型离子计允许用户查阅上次的标定数据以及查阅贮存数据。在仪器的起始状态或者测量状态下，按 “ 查阅 ” 键，并选择相应选项即可查阅上次标定数据和查阅存贮数据 （如图 26）。仪器按照测量的参数存贮数据，所有存贮数据支持 GLP 规范。

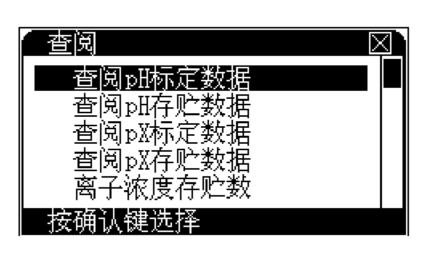


图 26

查阅 pH 存贮的数据

仪器允许存贮 pH 测量数据 200 套。

在起始状态，按“查阅”键，选择“查阅 pH 存贮数据”则显示如图 27，其中显示屏上方显示当前查阅模式以及实际的存贮数；每页最多可显示 10 个存贮数据，显示情况随不同查阅模式而不同，主要包括存贮时间、操作者编号等。

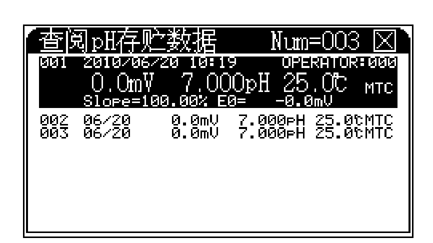


图 27

用户按方向键查看每个存贮数据。此时，如果用户需要删除存贮数据，按“删除”键选择相应操作。如果需要打印输出存贮数据，按“输出”键（首先通过 USB 连接线连接 PC，具体设置参阅打印输出功能）选择相应操作，其输出格式大概如下：

```
========================
MODEL
                  3200I
              ION METER
VERSION
               VER 1.00
PRINT TIME
               10:25:42
             2010/06/20
OPERATOR NO
                    000
************************
STORED NUM:         003
************************
                 NO:001
OPERATOR NO:        000
STORED TIME:   10:19:00
             2010/06/20
SLOPE:          100.00%
E0:              -0.0mV

POTENTIAL:        0.0mV
pH:             7.000pH
TEMP:             25.0c
TC.TYPE:            MTC
************************
                 NO:002
OPERATOR NO:        000
STORED TIME:   10:19:00
             2010/06/20
SLOPE:          100.00%
E0:              -0.0mV

POTENTIAL:        0.0mV
pH:             7.000pH
TEMP:             25.0c
TC.TYPE:            MTC
************************
                 NO:003
OPERATOR NO:        000
STORED TIME:   10:19:00
             2010/06/20
SLOPE:          100.00%
E0:              -0.0mV

POTENTIAL:        0.0mV
pH:             7.000pH
TEMP:             25.0c
TC.TYPE:            MTC
========================
```

查阅 pX 存贮的数据

仪器按照离子模式存贮数据，每个离子模式允许存贮 pX 测量数据和离子浓度数据各 100 套，同时仪器最多允许存贮 6 种离子模式的测量数据，即 600 套 pX 测量数据和 600 套离子浓度测量数据。

在起始状态下，按 " 查阅 " 键，选择 " 查阅 pX 存贮数据 " 则显示如图 28，仪器显示对应离子模式下的 pX 存贮数据。用户按方向键查看每个存贮数据。此时，如果用户需要删除、输出存贮数据，按 " 删除 "、 " 输出 " 键选择相应操作即可。

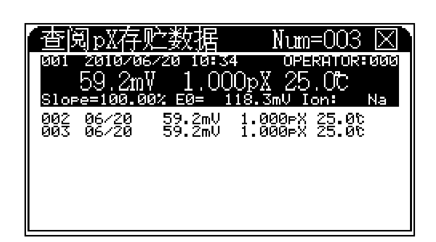


图 28

仪器支持多达 6 种离子模式的存贮数据。如果用户需要查看其他离子模式下的存贮数据，则可按 " 设置 " 键（或者模式键、或查阅键）用于切换其他离子模式。仪器提示 " 切换离子模式 " 字样，用户确认后即可查看其他离子模式的数据。图 29 即为查阅 Na 离子模式到查阅 Ag 离子模式。

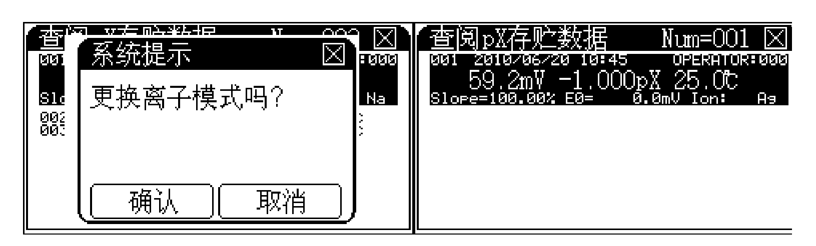


图 29

如果用户需要输出存贮的 pX 数据，按 " 输出 " 键并选择相应操作即可。（首先通过 USB 连接线连接 PC，具体设置参阅打印输出功能）。其输出格式大概如下：

```
========================
MODEL
                   3200I
               ION METER
VERSION
                VER 1.00
PRINT TIME
                10:26:23
              2010/06/20
OPERATOR NO
                     000
***********************
STORED NUM:          003
***********************
                  NO:001
OPERATOR NO:         000
STORED TIME:    10:34:00
              2010/06/20
SLOPE:           100.00%
E0:              118.3mV
POTENTIAL:        59.2mV
pX:              1.000pX
TEMP:              25.0c
ION NAME:             Na
***********************
                  NO:002
OPERATOR NO:         000
STORED TIME:    10:34:00
              2010/06/20
SLOPE:           100.00%
E0:              118.3mV

POTENTIAL:        59.2mV
pX:              1.000pX
TEMP:              25.0c
ION NAME:             Na
***********************
                  NO:003
OPERATOR NO:         000
STORED TIME:    10:34:00
              2010/06/20
SLOPE:           100.00%
E0:              118.3mV

POTENTIAL:        59.2mV
pX:              1.000pX
TEMP:              25.0c
ION NAME:             Na
========================
```

查阅离子浓度存贮的数据

同查阅 pX 存贮数据类型，具体可参见前面查阅 pX 存贮数据章节，如图 30 所示。



图 30

查阅 pH 标定数据

在仪器的起始状态下，按 " 查阅 " 键，选择 " 查阅 pH 标定数据 " 后，按 " 确认 " 键即可查阅 pH 的上次标定数据，显示如图 31，其中显示屏上方为上次的标定数据；下面为当前的标液组情况，此时用户可按 " ▲ "、" ▼ " 键查看详细的标定信息。或者可以按 " 设置 " 键设置标液组；打印标定数据等。

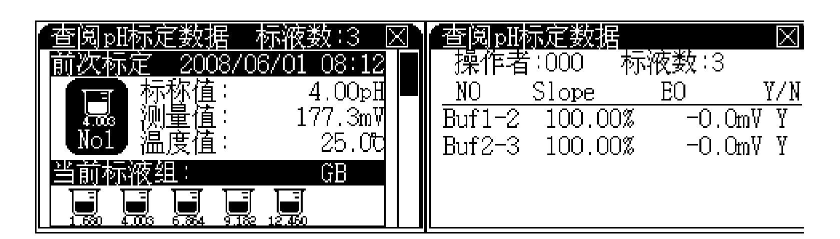


图 31

如果用户需要打印当前的参数数据，可通过 USB 连接线连接 PC，按 " 输出 " 键即可打印标定数据，具体设置请参阅打印输出功能。打印输出格式大概如下：

```
========================
MODEL
                   3200I
               ION METER
VERSION
                VER 1.00
PRINT TIME
                10:11:27
              2010/06/20
OPERATOR NO
                     000
************************
PH CALIB DATA
CALIB TIME:     08:12:00
              2008/06/01
OPERATOR NO:         000

                 POINT 1
pH:              4.003pH
POTENTIAL:       177.3mV
TEMP:              25.0c
************************
                 POINT 2
pH:              6.864pH
POTENTIAL:         8.0mV
TEMP:              25.0c
************************
                 POINT 3
pH:              9.182pH
POTENTIAL:      -129.1mV
TEMP:              25.0c
************************
CALIB RESULT
SLOPE 1:         100.00%
E0 1:             -0.0mV
SLOPE 2:         100.00%
E0 2:             -0.0mV
------------------------
```

查阅 pX 标定数据

在仪器的起始状态下，按“ 查阅 ”键，选择“ 查阅 pX 标定数据 ”并确认后即可查阅当前离子模式下的标定数据，如图 32。

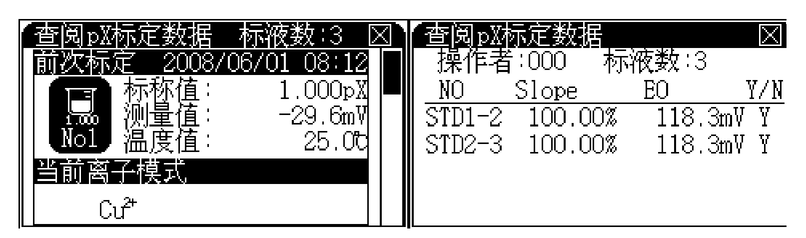


图 32

仪器显示上次的 pX 标定数据以及当前的离子模式。此时用户可按“ ▲ ”、“ ▼ ”键查看详细的标定信息。或者可以按“ 设置 ”键设置新的离子模式、打印标定数据等。如果用户需要打印当前的参数数据，可通过 USB 连接线连接 PC，按“ 输出 ”键即可打印标定数据，具体设置请参阅打印输出功能。打印输出格式大概如下：

```
========================
MODEL
                   3200I
               ION METER
VERSION
                VER 1.00
PRINT TIME
                10:23:44
              2010/06/20
OPERATOR NO
                     000
************************
PX CALIB DATA
CALIB TIME:     08:12:00
              2008/06/01
OPERATOR NO:         000
ION NAME:             Na
                 POINT 1
pX:             1.000pX
POTENTIAL:        59.2mV
TEMP:              25.0c
************************
                 POINT 2
pX:             5.000pX
POTENTIAL:      -177.5mV
TEMP:              25.0c
************************
                 POINT 3
pX:             7.000pX
POTENTIAL:      -295.8mV
TEMP:              25.0c
************************
BLANK CONC:
CONC:     0.000e+00mol/L
************************
CALIB RESULT
SLOPE 1:         100.00%
E0 1:            118.3mV
SLOPE 2:         100.00%
E0 2:            118.3mV
========================
```

关闭 3200I 型离子计

使用完毕，如果需要存贮数据请确保已按 " 贮存 " 键，此时按仪器的 "On/Off" 键关闭仪器。测试完样品后，所用电极应浸放在蒸馏水中。如果仪器长期不用，请注意：

1 断开电源适配器的电源，以免损坏电源适配器并间接损坏仪器，给您带来不必要的损失！
2 仪器的插座必须保持清洁、干燥，切忌与酸、碱、盐溶液接触。
3 仪器不使用时 , 短路插头也要接上，以免仪器输入开路而损坏仪器。
4 测量结束，建议将电极存放在参比填充溶液中。对可充电极，将加液塞塞上。长期不使用时，将电极放回盒体内室温保存。

更正问题

1 接通电源后 , 若显示屏不亮 , 应检查电源适配器是否有电压输出。
2 仪器不使用时 , 短路插头也要接上，以免仪器输入开路而损坏仪器。
3 仪器必须有良好的接地，防止腐蚀性气体侵入。
4 若上述各种情况排除后 , 仪器仍不能正常工作 , 则与有关部门联系。

软件通讯操作

安装电化学数据采集软件

安捷伦为 3200I 型离子计与计算机通讯提供了电化学数据采集软件。

本软件是为了方便用户使用而开发的一套数据采集软件（本软件 G4390A 需要另外购买）。如果用户需要，请选择安装。

按照数据采集软件说明来安装，安装完毕后，可以从桌面图标或“开始”菜单打开软件。

软件通讯界面操作

1 连接仪器电源，按 “On/Off” 键打开仪器。
2 用 USB 连接线连接仪器与 PC 机。

在 PC 机运行电化学数据采集软件，软件将自动识别连接的仪器型号、类型，并自动配置相应的功能；详细参见电化学数据采集软件使用说明书。

安装数据打印软件

安捷伦为 3200I 型离子计提供了免费的数据打印软件。是为了方便用户使用而开发的数据打印软件。如果用户需要，请选择安装。

数据打印软件界面操作

1 连接仪器电源，按 “On/Off” 键打开仪器。
2 连接仪器与 PC 机。
3 在 PC 机运行数据打印软件。当仪器处于测量状态、查阅上次标定数据或者查阅存贮数据时，用户按“输出”键，软件将接收仪器发送的数据，用户选择打印即可，详细参见数据打印软件使用说明书。



3
3200I 型离子计故障排除

此文档提供仪器基本故障解决方法，如果在使用过程中，仪器出现故障，可根据本文件排除基本故障。

仪器基本故障以及解决办法

编号	故障项目	故障原因	解决办法
1	仪器开机不显示	**1** 电源适配器安装有问题 **2** 使用的电源与要求的不一致 **3** 电源适配器损坏 **4** 电源插座接触不良 **5** 可能液晶损坏（开机一段时间后，按“开关”键能听到蜂鸣声，但液晶始终无显示）	**1** 按说明书重新安装 **2** 请使用仪器要求的电源 **3** 更换电源适配器 **4** 保证接触良好 **5** 联系代理商
2	按键无蜂鸣声	**1** 按下了无效的按键。 **2** 蜂鸣器损坏	**1** 选择有效的按键操作 **2** 联系代理商
3	按键无响应	**1** 按下了无效的按键 **2** 按键损坏	**1** 选择有效的按键操作 **2** 联系代理商
4	仪器不连接温度电极时不显示 25.0 ℃	仪器不连接温度电极时，仪器自动使用设置的手动温度值。	设置手动温度至 25.0 ℃。
5	测量时跳字严重，甚至无法正常测量	**1** 电极已损坏，或过保质期 **2** 周围有强干扰的信号存在	**1** 更换电极 **2** 隔开测量溶液与干扰源的联系，比如抬高测量溶液的烧杯；用仪器随机提供的接地线连接，一头连接仪器，一头连接干扰源的外壳。

仪器自诊断操作指导

在使用过程中，有很多因素会影响测量结果，包括测量使用的电极、标定电极斜率的标准溶液、样品溶液、测量时的温度、操作或者使用不当等等，对应 pX 值、离子浓度等的测量，情况可能更加复杂，还会与搅拌速度、离子强度调节剂等相关。当出现测量结果与预想的结果值相差甚远时，为了更好地快速判断是仪器本身还是仪器以外的因素导致测量误差，可以参照本操作指导进行简单的自我诊断。

仪器的电位值诊断

断开测量电极，仪器连接随机提供的短路插头；

开机，进入测量状态，此时仪器显示的电位值应该在 -0.5~0.5mV 之间，表示仪器硬件功能正常；如果零电位偏差较大，请使用校正零点电位功能，校正后电位值应显示为零值 (具体校正方法参见前面章节)；如果零点电位确实偏移很大，仪器无法完成校正，则说明硬件有问题，请联系相关部门。

仪器的 pH 值诊断

断开温度电极；仪器将使用设置的手动温度值，将手动温度设置为 25.0 ℃ (具体参见设置手动温度章节)。

进入 pH 测量状态，电位为零时，仪器显示的 pH 值应该在 6.99~7.01pH，则表明仪器的电极标定数据满足测量要求，否则有可能是电极标定数据不正确造成，需要进一步查看电极斜率。按 “ 查阅 ” 键选择 “ 查阅 pH 标定数据 ” 项并确认后，可查看前一次的标定情况以及电极斜率值。如果标定数据严重超出测量要求 (仪器显示有错误标记，错误号参见后面的表格)，则表示前一次的标定有问题，可能导致较大测量误差，需要重新标定，标定时请注意标液组的选择。注意，在测量状态下，仪器也会有同步的错误提示。

仪器的温度诊断

仪器连接随机提供的 ATC 温度诊断工具（5185-8390），开机，进入测量状态，此时仪器显示的温度值在 49.0~51.0，则表示仪器的温度测量正常。如果偏差很大，则表示仪器硬件有问题，请联系相关部门。

仪器的恢复默认值诊断

为了彻底验证仪器，可以使用恢复默认设置功能，将 pH 电极斜率恢复到默认值 100%，电极零点为 0.0mV，手动温度为 25.0 ℃的理想状态。注意，使用本功能后，仪器在恢复电极标定数据的同时，还将恢复其他的默认设置，包括其他离子的标定数据，当前的离子模式等，请用户注意。退出测量状态，在仪器的起始状态下，按 “ 设置 ” 键选择 “ 恢复默认设置 ” 项并确认，即可恢复默认值。然后按照上述步骤再次验证仪器是否存在问题。

按照上述方法可简单判断是仪器本身硬件、电极标定数据，还是电极以外的测量因素导致测量误差。对应仪器以外的原因，用户可以使用类比的办法，将电极放置在不同的标准缓冲溶液中，查看测量的电位或 pH 值，类比判断是电极本身，还是溶液问题，抑或是其他原因。

仪器的 pX 值诊断

当用户测量 pX 值出现很大偏差时，其情况比 pH 的测量要复杂得多，本操作只能简单判断仪器本身，其他的干扰因素请参见相关的专业应用知识。仪器的诊断请参照前面电位值诊断、温度值诊断和 pH 值诊断方法。

仪器自诊断相应代码与说明

本仪器支持自诊断功能，能描述常规的由于仪器本身、电极本身、溶液本身、或者操作本身而导致的一些错误。针对错误的严重程度，仪器予以区别对待和处理。通常仪器分为二大类错误，一类是严重的系统错误，这类错误将直接影响仪器进一步使用，无法完成必要的工作，而不得不做更换、维修等处理；另一类错误较为轻微，属于提示、警告之类。这些错误由多种原因导致，同样可以有多种方法解决、应对。用户必须重视这些警告，才能保证测试数据的完整性、可靠性。当然，用户可以忽略这些警告和提示，而不影响仪器的使用。

严重错误

仪器发现严重错误时，将直接停机，并提示错误，此时用户除了关机外无法进行任何操作。提示图如下：

IMPORTANT MESSAGE
If you see this message
first time,shutdown the
meter and try again.
If not you may calling
us for more help now!

图 33

警告错误

在使用过程中，由于电极本身、溶液本身或者操作本身等原因导致错误警告的出现，用户应重视这些错误提示，仔细阅读操作提示，并严格按照仪器说明书、电极说明书操作、保养和使用，将错误减少到最小。

图示即为测量 pX 时，由于温度超出测量范围而出现的错误警告。

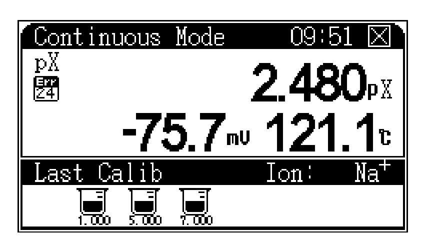
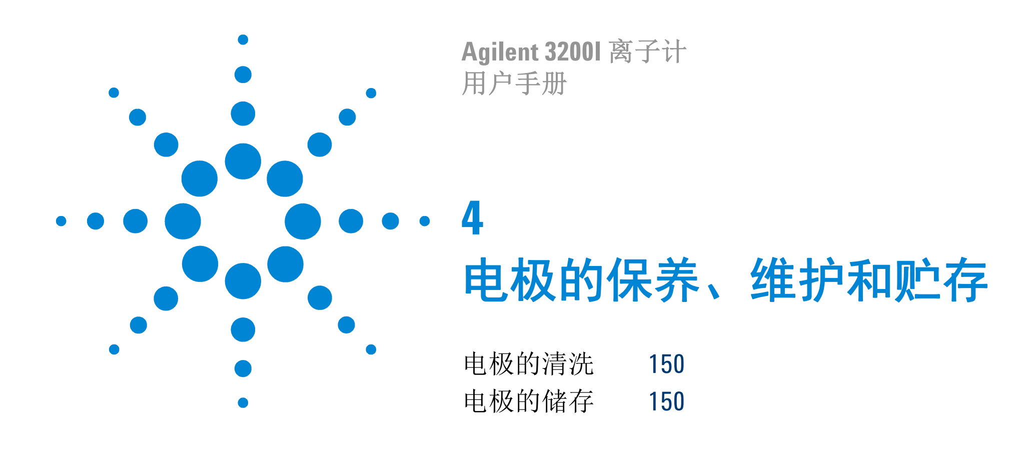


图 34

为错误警告标志，数字表示错误代码，具体见下表的描述。注意：下表内容为多参数所有错误号的描述，对应不同仪器，用户查看相关内容即可。

表 错误警告代码表

NO	代码	描述	解决办法	备注
1	00	电导测量模块错误	联系代理商	严重错误
2	01	溶解氧测量模块错误	联系代理商	严重错误
3	02	温度测量模块错误	联系代理商	严重错误
4	03	数据存贮错误	联系代理商	严重错误
5				
6				
7	20	电位超出量程	更换电极	-1999.9~1999.9mV
8	21	pH/pX 超出量程	更换电极	-3.000~21.000pH
9	22	电导率超出量程	更换电极、更换溶液	0~2000mS/cm
10	23	电阻率超出量程	更换电极、更换溶液	0~100Mohm.cm
11	24	温度超出量程	更换电极、降低溶液温度	-6.0~120.0 ℃
12	25	溶解氧电流超量程	更换电极	0~4000nA
13	26	pH 电极斜率超范围	更换电极、重新标定	80~120%
14	27	无法识别 pH 标液	更换电极、设置合适的标液组、更换标液	
15	28	pH 标液温度超范围	降低标液温度	
16	29	重复标定同一种标液	更换标液	操作错误导致
17	30	选择的 pH 标液数已最大	先清除某个标液	最大标液数 5 个
18	31	pH 标液相互有冲突	先清除相邻标液	
19	32	到达最大存贮数据	可选择覆盖后，从头存贮	不删除全部数据
20	33	时钟电池电压过低	手动设置时间	
21	34	最大用户自定义离子数	删除不必要的离子	
22	35	最大存贮离子模式数	删除某个离子模式下的全部存贮数据	



4
电极的保养、维护和贮存

本节描述相关电极的保养、维护和贮存信息。



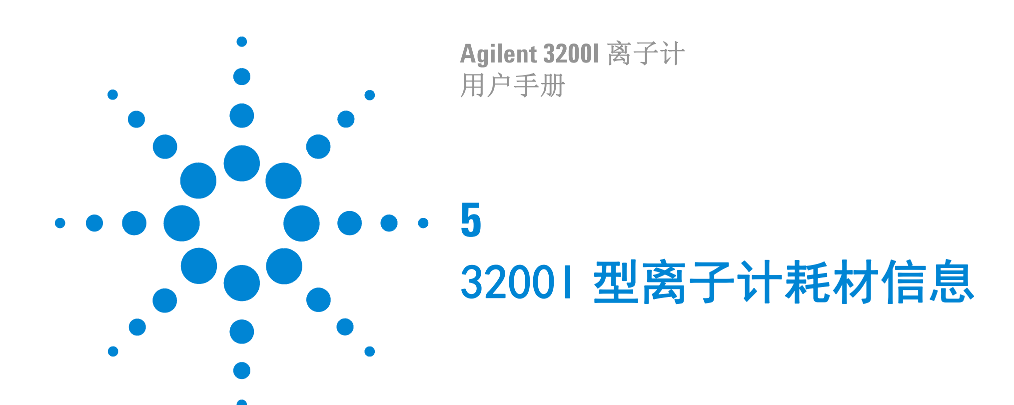
电极的清洗

对应不同的电极污染程度和污染物性质，电极的一般清洗方法，包括无机物清洗、有机物清洗、油脂类清洗、蛋白质沉淀清洗、玻璃敏感膜再生等等。通常进行一种或两种以上清洗后，用蒸馏水清洗电极外部，将填充溶液吸空，加满新鲜的填充溶液，如此重复 2-3 次。在 pH 电极填充溶液中浸泡至少一个小时。

电极的储存

不使用时，建议将电极存放在填充溶液中。对可充电极，将加液塞塞上。

长期不使用时，将电极放回盒体内室温保存。



5
3200I 型离子计耗材信息

此文档提供 3200I 型离子计的耗材信息，内容包括订货号，名称和描述。



3200I 型离子计耗材信息

订货号	型号名称	描述
G4388A	3200SA 型搅拌器	将电极支架和磁力搅拌器组合，能在较大的范围内对溶液进行稳定和精密的搅拌
G4389A	3200EA 型电极支架	各种不同电极的固定装置
5185-8389	电源适配器	100~240VAC， 1A， 50/60Hz
G4383-40000	短路插头	用于仪器零电位校正和电位值诊断
G4388-27000	搅拌棒	搅拌器配套用
5190-4002	I9111 型氟离子复合电极	二复合电极、塑壳、可充式
5190-4004	I9121 型氨气敏复合电极	二复合电极、塑壳、可充式
5190-4005	I9131 型钠离子复合电极	二复合电极、玻壳、可充式
5190-3988	P3211 型 pH 复合电极	二复合电极、玻壳、可充式
5190-3989	P3212 型 pH 复合电极	二复合电极、塑壳、不可充式
5190-3990	P3311 型 pH 三复合电极	三复合电极、玻壳、可充式，
5190-3991	P3111 型 pH 电极	玻壳，单电极
5190-3992	P3213 型 pH 复合电极	二复合、塑壳、可充式、平板
5190-3993	P3214 型 pH 复合电极	二复合、塑壳、不可充式、锥形、
5190-4003	R8111 型参比电极	玻壳、陶瓷砂芯、 Ag/AgCl、单盐桥式
5190-3999	ORP8211 型 ORP 电极	二复合电极、玻壳、可充式
5190-3998	T7111 温度电极	不锈钢外壳，测量范围 0 ～ 100 ℃
5185-8390	ATC 温度诊断工具	温度诊断
5190-0533	pH 缓冲试剂套装	瓶装， 3 × 250 mL， 4.01、 7.00、 10.01 pH
5190-0534	pH 缓冲试剂套装	瓶装， 3 × 250 mL， 4.00、 6.86、 9.18 pH
5190-0538	pH 4.00 缓冲试剂	瓶装， 3 × 250 mL
5190-0535	pH 4.01 缓冲试剂	瓶装， 3 × 250 mL

订货号	型号名称	描述
5190-0539	pH 6.86 缓冲试剂	瓶装， 3 × 250 mL
5190-0537	pH 7.00 缓冲试剂	瓶装， 3 × 250 mL
5190-0540	pH 9.18 缓冲试剂	瓶装， 3 × 250 mL
5190-0536	pH 10.01 缓冲试剂	瓶装， 3 × 250 mL

备注：Agilent 建立了一个客户门户网站，可为您所拥有的产品提供详细的相关信息。该门户网站的登录地为 http://www.agilent.com/chem。

如需购买，请与安捷伦经销商联系或者登陆安捷伦官方网站。

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